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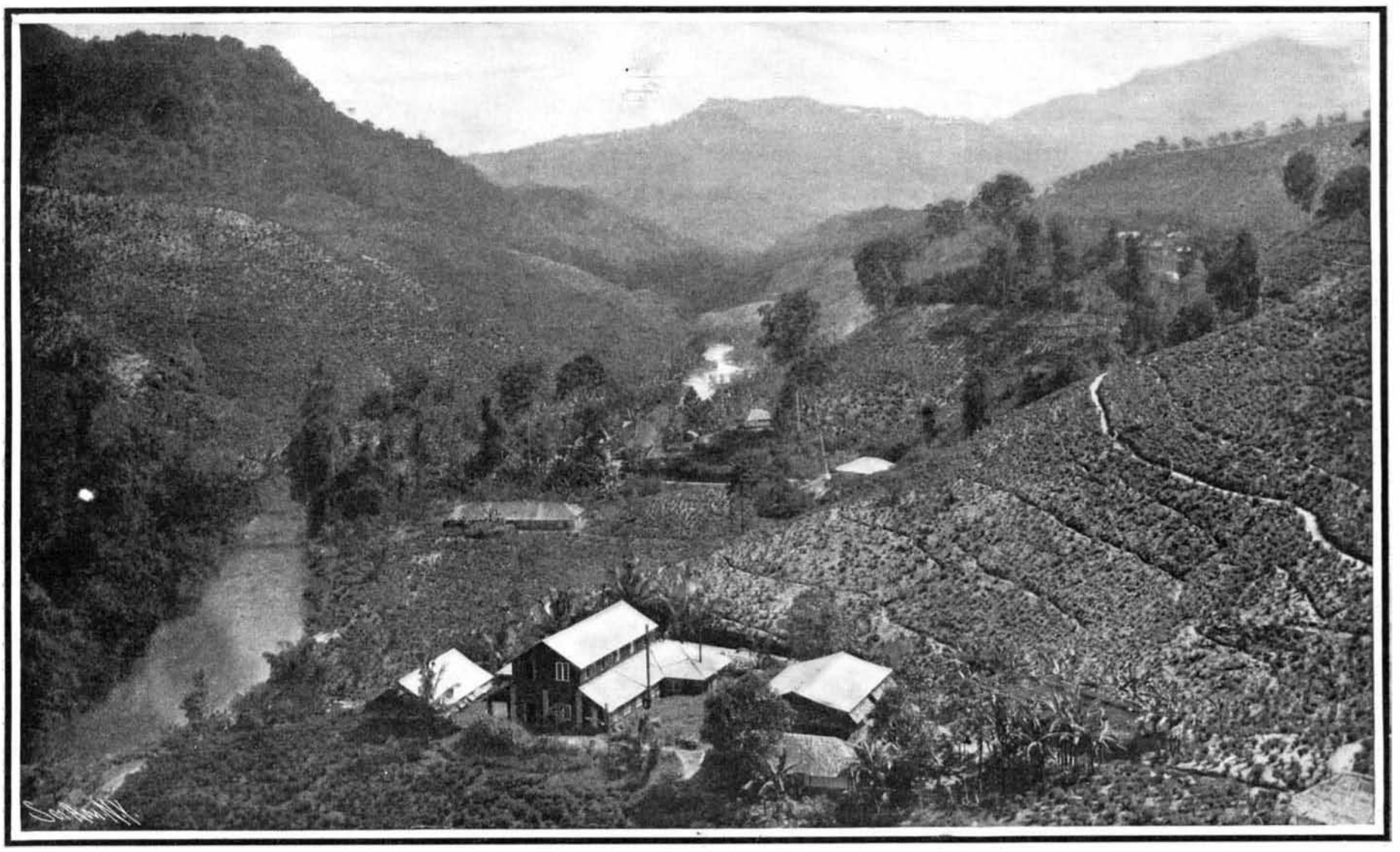
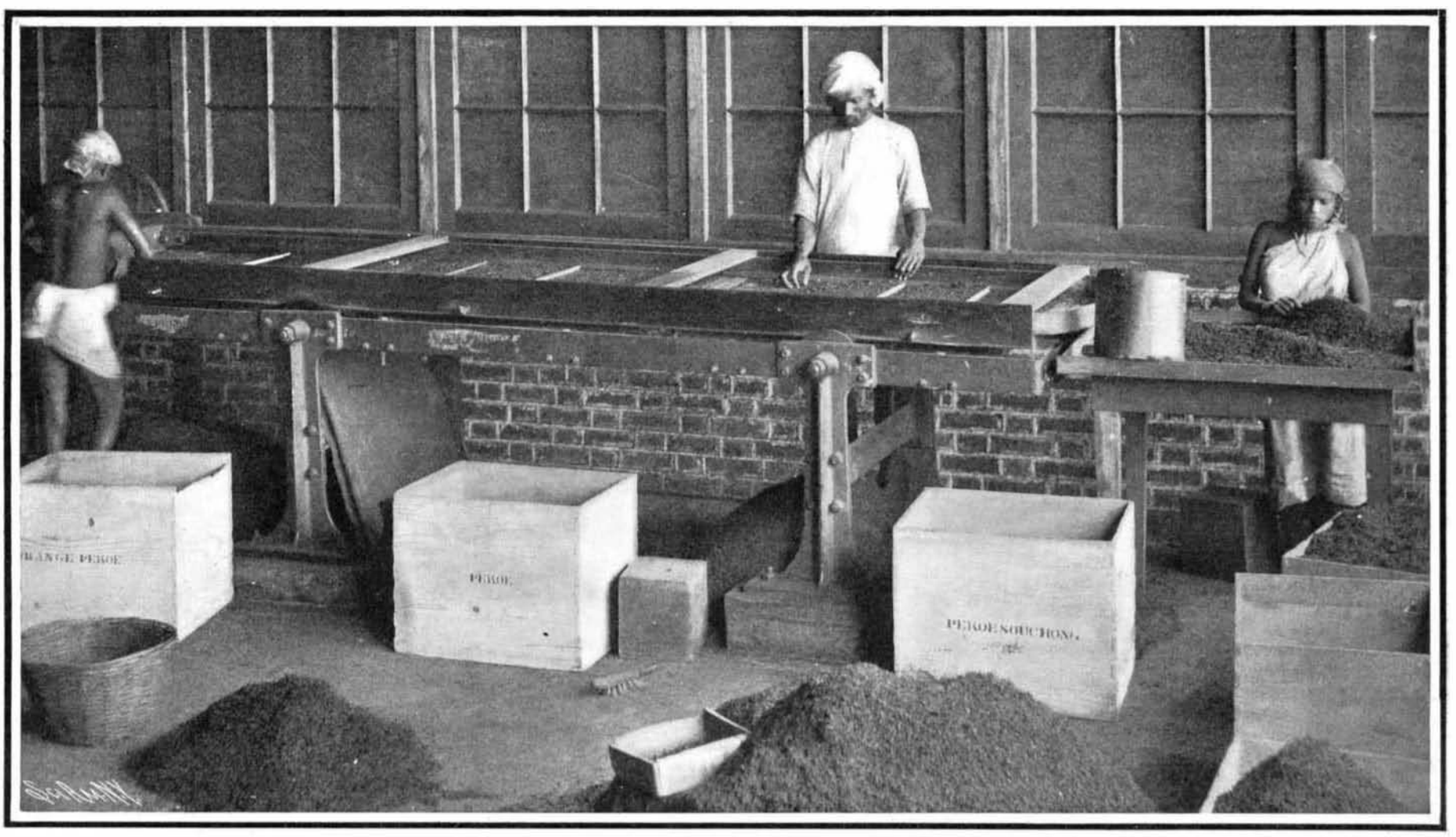
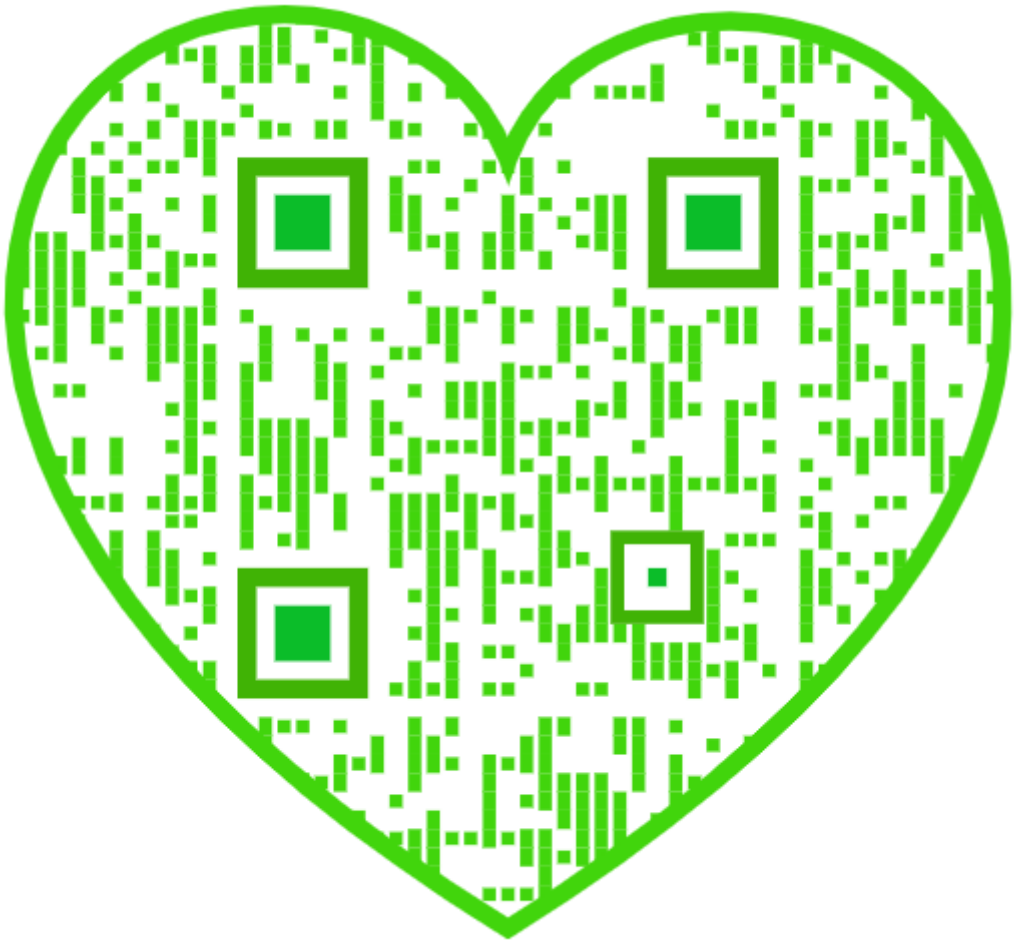


General View of a Tea Plantation in Ceylon.



A Tea Sifting Machine.

THE SCIENTIFIC CULTURE OF TEA.—[See page 357.]



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NEW YORK, SATURDAY, NOVEMBER 19, 1904.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

INCREASING RAILROAD FATALITIES.

The Interstate Commerce Commission is doing valuable work in collecting and publishing, every quarter, the statistics of railroad accidents for the preceding three months. It was only by the institution of such a commission, equipped with ample authority, that the country could keep itself informed on this most momentous question. The steam railroad enters so thoroughly into our modern life that the question of the safety of travel touches the citizen very closely, and while it is a fact that the killing of passengers is the one thing above all others that an up-to-date railroad management wishes to avoid, it cannot be denied that the publicity given to accidents by these bulletins of the Interstate Commerce Commission is a decided safeguard to the life and limb of the traveling public. On the other hand, it is a most disquieting fact that the statistics of train accidents for the year ending June 30, 1904, show not only the largest record of deaths and injuries, but one that has never been approached in any year covered by the investigations of the Interstate Commerce Commission. Last year 3,787 passengers and employes were killed and 51,343 were injured in train accidents. In the previous year, 3,564 were killed, and 45,977 injured, and in 1902, 2,819 were killed and 39,800 more or less severely injured. This is an increase in two years of nearly one thousand, or 34 per cent, in the number of killed, and over 11,500, or 29 per cent, in the number of injured. Now, just what these figures mean can be understood when we remember that they far exceed in killed and wounded the losses in some of the greatest battles of the present Japanese-Russian war, battles which we are informed will go down to history as among the most bloody on record.

In casting about for an explanation of this appalling list of casualties, various causes have been suggested. Two years ago, the increase in railroad accidents was attributed to the enormous volume of traffic due to an exceptional era of prosperity. This necessitated the employment of a large number of green hands who had to be broken to new duties, and to handle apparatus with which they were not familiar. The past two years have seen a return to normal conditions; and yet the ratio of accidents has greatly increased. Of the causes which may have contributed to this increase, we think one of the most fruitful has been the higher speeds at which trains are now run. Because of the heavier dynamic forces acting on the track, the bridges, and in the rolling stock, there must be a more rapid deterioration; moreover, the higher running speeds render the chances of avoiding collision by sudden application of the brakes smaller than they were, while the greater momentum renders a collision or a derailment proportionately more fatal. These considerations are strengthened by the fact that the weight of engines and cars has gone up enormously in the last few years, and weight is the other important factor with velocity that shortens the life of track and structures, and increases the smashing effects of a collision. It is difficult to explain the apparent increase in carelessness or absent-mindedness among employes, an increase which is very largely responsible for the growing list of fatalities. Orders apparently are read, understood, and by some curious mental aberration are entirely disregarded. This has been particularly true on single-track railroads. Many recent accidents have been due to trainmen failing to wait at the designated station for a train coming in the opposite direction. In one notorious case, the engineer and conductor were old employes who had been running that particular train carefully and successfully for many years. If accidents can happen in a case like this, the obvious lesson is that the single-track road and the train-order method of operation are an extremely perilous combination. The only sure remedy is to double-track such roads and run them under some form of the block signal system. Of course, in many cases this could not be done for the reason the outlay involved would throw the road into immediate bankruptcy; but there are undoubtedly thousands of miles of single track in the United States whose owners could well afford to make the change, and would find that in the long run it was a profitable improvement.

In the presence of this awful fatality list, does it not look as though the time had come when the Interstate Commerce Commission should be authorized by the government to render the installation of a block signal system imperative upon every road that is in a financial condition to warrant the outlay? The Commission was given such power with regard to automatic coupling and the air brake, and much fatality and suffering has been prevented by that most wise provision. If similar powers were conferred with regard to the question of signals, the Interstate Commerce Commission would succeed, we do not doubt, in reducing the annual list of deaths and injuries to a rate less alarming than that which now prevails.

THE VENTILATION OF THE SUBWAY.

It was inevitable that soon after the opening of the Subway, public attention should be directed to the question of its ventilation. When a traveling public that has been accustomed to ride on elevated railroads, where the amount of fresh air is unlimited, commences to travel in a tunnel, it will naturally be apprehensive as to the purity of the air therein; and those who have an instinctive dislike to underground travel, are pretty sure to be seized with an instant conviction that the air is more or less foul and pernicious. In the case of the New York Subway the inevitable has happened, and some very alarming statements have been made as to the small amount of oxygen and large amount of poisonous gases that are to be found there, even at this early stage of its operation.

It is not for the SCIENTIFIC AMERICAN to decry a reasonable agitation of this subject, inasmuch as we have several times during the construction of the road suggested that, when it came to be opened, conditions might result which would necessitate some form of mechanical ventilation in that portion of the Subway lying below 59th Street. What we do protest against is the publication of results of so-called investigations, containing statements as to the bad condition of the Subway atmosphere, which, if they were true, would involve the decimation by disease of the passengers, to say nothing of the operators who spend ten hours a day in Subway service. It is not to be expected that an analysis of the air twenty feet below ground in an inclosed four-track road that carries several hundred thousand people a day, will give as good results as that of air taken at the street level; but that conditions are anything like as bad as has been suggested, is quite out of the question. Even the London tubes, which lie at places some sixty to eighty feet underground, do not show as bad results.

A careful observation of conditions since the opening of the road, seems to prove that the theory of the engineers as to ventilation is to a certain degree correct. It was believed that the moving trains would induce sufficient drafts, and movements of the air as a body, in the Subway to maintain a thorough circulation and renewal. In the course of a trip over the whole length of the line, made with a view to special observation of this feature, a member of our staff noted that on that particular day, with a fresh northwesterly breeze blowing, strong currents of cold air swept through the westerly and northerly entrances and exits at the stations, and that an equally strong current of warm air poured out through the easterly and southerly exits. On the station platforms, it was noted that the local trains carried into the station ahead of them a body of air that moved at a considerable velocity, and that while standing on the local platform twenty feet away from the express tracks, the wave of air carried ahead of the expresses as they swept through the station was distinctly discernible. The air throughout the tunnel on that day was apparently fresh and sweet; though it must be admitted that the conditions were ideal, the trip being taken in the middle of the afternoon, when travel was not heavy, and on a day when a cold northwesterly breeze was blowing. The supreme test of the ventilation occurs, of course, toward the close of the rush hours, and on days when the atmosphere is muggy and there is no breeze blowing to assist in creating drafts at the station exits. Whether the movement of trains and the provision of eight stairway openings at intervals of a quarter of a mile along the road will prove equal to the task of periodically renewing the whole body of air in the Subway, has yet to be proved. It must be borne in mind that it is renewal, and not mere circulation, of the air in the tunnel that is desirable.

The tests which have been ordered by the Board of Health will be made with every refinement known to modern science, and the results can be accepted as absolutely accurate. If it should prove that the percentage of carbonic-acid gas exceeds the safe limit for health, it will be possible to remedy matters by the installation of mechanical ventilation on such sections of the road as may be affected. Should the present official investigation prove that changes are necessary, the public may rest satisfied that the company, which has shown such liberality in equipping the new system, as far as its rolling stock and motive power are concerned, with the very best that the state of the art affords, will do everything that is necessary to render the Subway atmosphere perfectly wholesome.

THE MINING DEBRIS PROBLEM IN CALIFORNIA.

In the early days of gold mining in California, the operations consisted of the washing and concentration of the surface gold-bearing deposits, which were found along the western slopes of the Sierra Mountains and near the headquarters of certain rivers and streams that entered the Sacramento and San Joachin valleys. The process of recovery was the simple one of washing and amalgamating, which was done at first by the simple miner's pan and riffle, and later on a much vaster scale by means of hydraulic mining. Under the latter system the gravel beds were broken up and washed into the sluices by means of streams of water directed at enormous pressure from nozzles which in some cases were as large as nine inches in diameter. Under the terrific impact of the water, whole hillsides were broken up and washed away, the quicksand and gravel being swept into the canyons and small streams in the vicinity, to be ultimately carried farther and farther down into the valleys with each succeeding season's floods. The accumulations of debris at last reached the lower and fertile valleys, where they choked up the streams and caused heavy overflows, during which the sand and gravel were carried out over the adjoining land, and deposited in enormous quantities. The complaints of the owners of the valley property resulted, in 1883, in action by the courts in California, which put a complete stop to hydraulic mining, and about ten years later, Congress appointed the California Debris Commission, consisting of three army officers, who were to permit hydraulic mining under such conditions as would prevent obstruction of the navigable waters of the United States. The commission also was charged to make plans for restoring the channels of rivers in the Sacramento and San Joachin valleys, so as to render them once more navigable.

This important work is now well under way, and the means adopted by the army engineers present one of the most interesting studies in this class of work. In the current issue of the SUPPLEMENT will be found an illustrated article by one of the United States army engineers, describing the extensive work that is being done in reclaiming the Yuba River, which was selected because it had suffered more than any other river in California from the accumulation of mining debris. In 1849 the Yuba was a narrow stream running between lofty banks in its upper portion, and winding through the lowlands to a juncture with the Feather River. At the present time this stream contains over 70,000,000 cubic yards of mining debris. The lower river, once a narrow stream, is now in the neighborhood of three miles in width, and the mining debris varies from 24 feet to about 125 feet in depth. The river during low water winds through this deposit in a narrow stream, and at high stages the entire bed is covered with a rushing flood. The plan of the commission provides for holding in place, and preventing any further movement downstream, of this enormous deposit of waste material. It also aims to prevent any further accumulation, by holding back such debris as may in future be carried down from the upper reaches. These results are to be secured, first, by building barriers across the river to prevent the coarse detritus, consisting largely of heavy bowlders, from being carried down from the upper branches of the river; secondly, the provision of a huge settling basin, six miles below the embankment, for the impounding of flood waters carrying fine material, whereby the suspended matter may be deposited; and thirdly, the confining of the river to a selected channel, by means of training walls. The work that has already been done has been subjected to a heavy flood, and its action gives reason to believe that when the whole plan is completed, the government will succeed in repairing the great damage that has been effected in the Yuba district.

WORK ON THE SIMPLON TUNNEL

It is expected that the two sections of the Simplon tunnel, which are being carried forward on opposite sides, will come together by the end of the year. The work on the tunnel has been greatly hindered by the springs of hot water which were met with on the north end, and special precautions had to be taken to draw off the water as fast as it came, and also to keep the tunnel cool enough for the workmen. As far back as last November a flow of water had been encountered on the north section of the tunnel at 1,000 feet beyond the point of highest level. This made it necessary to stop all the drilling, not on account of the volume

of water, which was only 20 gallons per second, but owing to its temperature, which equaled 48 degrees C. For this reason the work was suspended in the north end and during November, 1903, only 260 feet had been cut on that side, while on the opposite side 525 feet were cut. In December, the southern side had advanced 460 feet, while the northern remained stationary. In the south end some very hard rock was encountered, composed of gneiss and mica schist, and here the advancement was only 16 feet per day. The total length of the tunnel is 64,119 feet, and by December 31 the north end had reached 32,968 feet, and the south end 25,194, making a total of 58,162 feet, and leaving 5,957 feet to be finished. But on account of the water flow which had been met with in November, steps had to be taken to carry off the water before any further work could be done on that side. The hot water which had filled the tunnel in the farther end, which sloped downward, was first drawn off and the pumping was continued until the two springs at this point delivered only 20 gallons per second. The conditions were not the same here as for the cold springs on the Italian side. The hot springs come from great depths of the earth and are inexhaustible, while the cold springs are fed by surface water and the flow diminishes as this supply is lessened. When the hot water had been drawn off as fast as it appeared, it became possible to remain in the gallery, as the heat was overcome by means of atomizers. These were already in use in some parts of the tunnel.

The south end was continued until the geological inspection of the strata gave evidence that the water-bearing layer lay not far off. The work was accordingly discontinued so as to avoid meeting the water flow. In the north end a cross-gallery was dug, starting some 10 to 20 feet back of the end where the water occurred, and coming to an end at the point where the south tunnel was to stop, so that they could bore from here to the end of the latter section. At the end of each gallery a solid wall was built, and each wall had a manhole and different openings for admitting the pipes for the air, cooling water, and drain pumps, using tight joints. Beyond the two walls the work of drilling was then taken up, but this time by hand. This operation was quite successful. However, in January the work had to be suspended on the north side on account of a great water flow which reached a total of 15 gallons per second from the two springs. Two pumps were installed to draw off the water, at the 3,200-foot point of the tunnel. Drilling was then continued by hand in the parallel gallery, and on January 31 the latter had reached a depth of 32,672 feet, counting from the mouth of the main tunnel. The end of the latter remained as before at 32,968 feet. At the end of January the work of drilling the transverse gallery which led to the south end was commenced, starting from the 32,925-foot point of the main tunnel. The south tunnel advanced by 475 feet, or at the rate of 14.5 feet per working day. At this time the latter tunnel had reached 25,669 feet, which, with the 32,968 feet on the other section, gave a total of 58,637 feet, leaving 5,482 feet to be finished.

The mechanical drilling of the north end was recommenced on the 20th of March. During the month of April it pierced through calcareous schists and the advance was about 13 feet per day. The temperature at the end of the tunnel reached 115.7 deg. F. At the south end, the tunnel advanced through granitiferous mica schists with veins of quartz. The drilling progressed at the rate of 20 feet per day. The temperature here was 92.2 deg. F. The water in the south end was carried off without any trouble, as before. At the end of June there were but 2,057 feet remaining to be finished, and allowing 475 feet per month, there would still be about five months' work, and this would bring the junction of the two ends of the tunnel up to the last part of November. After this, six months more must be counted for the entire completion of the tunnel, and this gives the finishing of the enterprise at the first of June, 1905. This calculation supposes that the south end will not meet with an excessive flow of hot water when it arrives at the place where the springs are located.

The air supply plays an important rôle in connection with the tunnel construction. In the north tunnel the temperature rose as high as 119.8 deg. F., and then fell to 107.9 deg. On the other side it rose regularly to 101.1 deg. The temperature is taken at a depth of five feet in the side of the rock, as near as possible to the end of the tunnel. Great care was taken to secure a good ventilation, especially on the north side, and the result was quite satisfactory. The mean temperature of the air, in spite of the heat of the rock, is only 86 deg. F. The quantity of air sent in is only slightly higher than last year, but this air is cooled several times and in different ways before it comes to the different working points. The air is brought from the exterior by way of the parallel gallery and is cooled at the 21,870-foot point by a large water-spray apparatus. It then passes into the tunnel by one of the cross-galleries (at the 32,160-foot point) and then goes to the outside. Just back of the working front of the tunnel the walls are sprinkled plentifully by watering nozzles, and this lowers the temperature considerably. For the masonry working point there are two cooling apparatus placed at the entrance of the cross galleries. This apparatus has sixteen horizontal tubes 8 inches in diameter. In each tube is a jet of water. The air which passes in the gallery before the cooler is drawn through the tubes with great force and is cooled by the water sprays. Besides this, there are two large spray apparatus in the tunnel at the 31,600 and 26,550-foot points and another in the finished part of the tunnel at the 22,425-foot point. The use of ice cars has been entirely discontinued, as the system was not found practicable. On the south end the air is cooled in about the same way. The mean quantity of air sent into the tunnel per 24 hours is 30,000,000 cubic yards on the north side and 35,000,000 on the south.

THE AUTOMOBILE AND ITS UTILITY IN THE INDUSTRIAL DEVELOPMENT OF LATIN AMERICA.

BY MARRION WILCOX.

The employment of automobile trucks or trains which can run on ordinary wagon roads and serve as feeders to the railway and steamship lines is a subject which must before long command the attention of the governments of the Latin-American republics. By the introduction of the automobile truck or train a new era of industrial expansion is in store for South and Central America and the West Indies, which is likely to bring about the adoption of a special policy by many of the Latin-American governments. There is also an increasing social and commercial Europeanization of certain Latin-American communities going on which will aid in hastening the use of the automobile, especially in its advantages for the easy and rapid transportation of agricultural, and, to a smaller extent, of mineral products, over short distances and in regions where moderately good roads and bridges can be maintained. Within these strict limits the field is vast, and vastly interesting it is certain to become in the near future to statesmen and manufacturers alike.

Let us glance first at Cuba.

To the insufficiency of the supply of agricultural laborers is commonly, but erroneously, ascribed the circumstance that 100,000 tons of sugar cane were left in the fields of Cuba when the last crop was harvested; and now we find that the Cuban Congress has appropriated $800,000 to be expended for the encouragement of immigration—that is to say, practically to pay the expenses of families or individuals who shall cross the Atlantic (from Spain, as a rule) to help load, drive to the mill, and there unload, those primitive ox-carts and mule-carts that "creep like snail, unwillingly," with creaking remonstrance along the country roads. With excellent intentions, the Cuban government is following old-fashioned methods and practices. Of course the immigrants thus secured will serve other purposes as well; but a fact which will not escape the attention of anyone who is familiar with the conditions of Cuban agriculture is this: Given automobile trains, or capacious gasoline cars, with or without trailers (the engines and the trains being in all respects specially and perfectly adapted to the purpose of moving the sugar cane swiftly from field to mill, and the raw sugar from the mill to the railway or port of shipment) even the present laboring population would be sufficient to handle an average sugar crop thoroughly, and indeed to extend the area of cultivation. We shall realize the force of this assertion and reflect upon it as it well deserves (since it is applicable to a score of countries besides Cuba) if we remember that a large number of the best laboring men now employed in building, repairing, or driving the carts, and caring for the animals, would be available in that case for the planting and cutting. It may be said with the energy of positive conviction, though most courteously, that the best plan which the Cuban government could adopt for promoting the agricultural interests of the island would be to continue the admirable work for the improvement of highways which it has already begun, and to admit free of duty all machinery used in handling and transporting the crops.

It will be remarked with interest in this country that El Economista, a valuable review published at Havana, advocates in its issue of October 1 the reduction of duty on machinery and material for railways to two per cent *ad valorem*, with complete exemption to be accorded to that of American origin, in grateful recognition of the advantages conferred upon Cuba by the United States through the treaty of reciprocity.

A step in the right direction is thus advocated, since in Cuba, as in German East Africa and Togoland, automobile trains may soon be run on the wagon roads as feeders to the railway lines; and the Cuban government, when building bridges and improving roads, will be only following the precedent established by the German colonial administration in Africa. It is self-evident that an enormous increase in the national wealth of Cuba will result from extending the margin of cultivation, by the means indicated, so that it will include fertile tracts that lie at a distance from railway or port.

Similar but very much greater opportunities exist in other Latin-American countries. Thus it has been customary to say that the natural resources of some of the Mexican States are still almost wholly undeveloped—and, more pointedly, the mineral wealth of certain localities nearly untouched—simply because their railways, though long ago projected, it may be, are not yet in operation, or the existing lines of railway are inadequate. But good wagon-roads are common there, and it may be assumed that in automobile trains, to be run on ordinary roads, even such as have steep grades, will be found the best solution of the problem of bringing out the products of field, forest, and, in some cases, of the mines as well.

Again, in the Argentine Republic, Uruguay, and Paraguay—in general, throughout the valley which in so many respects is comparable with our Mississippi Valley—automobile trains are required in very large numbers, as feeders to railways, or as substitutes for short railway lines in many fertile regions bordering the Paraná, Paraguay, and Uruguay rivers, to transport both the products of the cattle-ranches and those cereal crops which are grown for export in rapidly increasing quantities. To southeastern Brazil, with its valuable crops of coffee, etc., the same system of transportation is applicable in a measure, though the natural features of the country are less favorable. In the aggregate, territory in Latin America nearly equal in size to all that part of the United States lying east of the Rocky Mountains may be brought within the margin of cultivation; and a year may ripen what the centuries never matured. It is a territory rich enough to secure immediately whatever is imperatively needed for its development, for we are considering now the moderately level or rolling agricultural country, the products of which are so valuable that the local governments are vying with each other to obtain immigration in many parts of the world—using the governmental resources to pay the expenses of settlers from point of departure to destination.

SCIENCE NOTES.

The 36½-ton meteorite which was brought to this country some years ago by Lieut. Peary has been removed from the Brooklyn navy yard to the American Museum of Natural History. It was necessary to use the big derrick owned by a wrecking company. The meteorite was landed at the West Fifty-fifth Street pier, Manhattan, whence it was brought to the museum on a large truck.

Up to the present it seems that hydrochinon has not been extracted from any living plant. It has now been extracted from the buds of the pear tree by Messrs. G. Riviere and G. Bailhache, of Paris. The buds are macerated in ether for a certain time, and in this case they lose the viscous matter which adheres to the scales. The ether solution is evaporated and the matter which remains is slightly heated. It is sublimed and yields some transparent crystals. The proportion of crystalline matter which is obtained is found to increase with the progress of vegetation. The experimenters show conclusively that the crystalline matter is hydrochinon, and they also prove that it exists in the buds themselves and is not a product of decomposition. What is somewhat singular is the relation between the pear and the apple tree in this respect. The buds of the apple tree do not yield hydrochinon, but on the other hand they contain a considerable quantity of phlorizine, and this latter body does not exist in the buds of the pear tree. In this way the two different species are each characterized by an appropriate chemical compound.

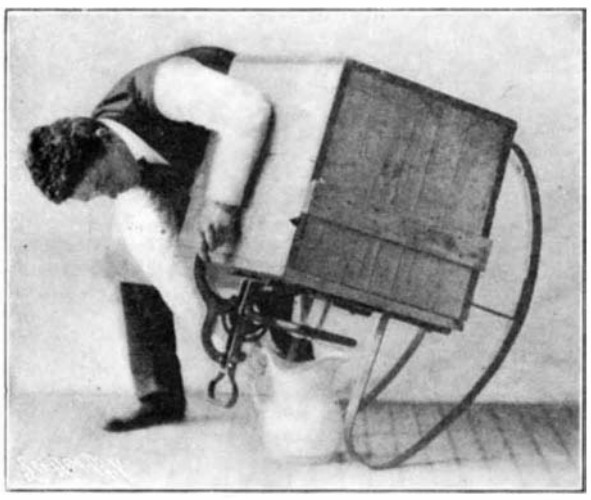
Among the most recent objects which have been found by the Rev. P. Delattre in the excavations at Carthage may be mentioned a sarcophagus of large size containing relief sculptures. The sarcophagus is of white marble and is painted, like some other specimens which have been found here. It was found along with some other objects at a depth of nearly 60 feet. On the two main faces of the sarcophagus is a relief which represents the monster Scylla with her arms extended. At the middle of the body are seen dogs which are facing in different directions, following the ancient tradition. The same subject has been found before upon a sarcophagus at Carthage, but in the latter case it is simply painted and not in relief. What is to be especially remarked concerning this group is that the same subject is found in the mausoleum of El-Amoroumi in Tripoli, which belongs to the later Punic period. It occurs among other well known mythological subjects. It is therefore of interest to find that at the Punic period of Carthage the myth of Scylla already occupies a prominent place. Up to the present it has only been found on Roman remains.

A CARBOY INCLINATOR.

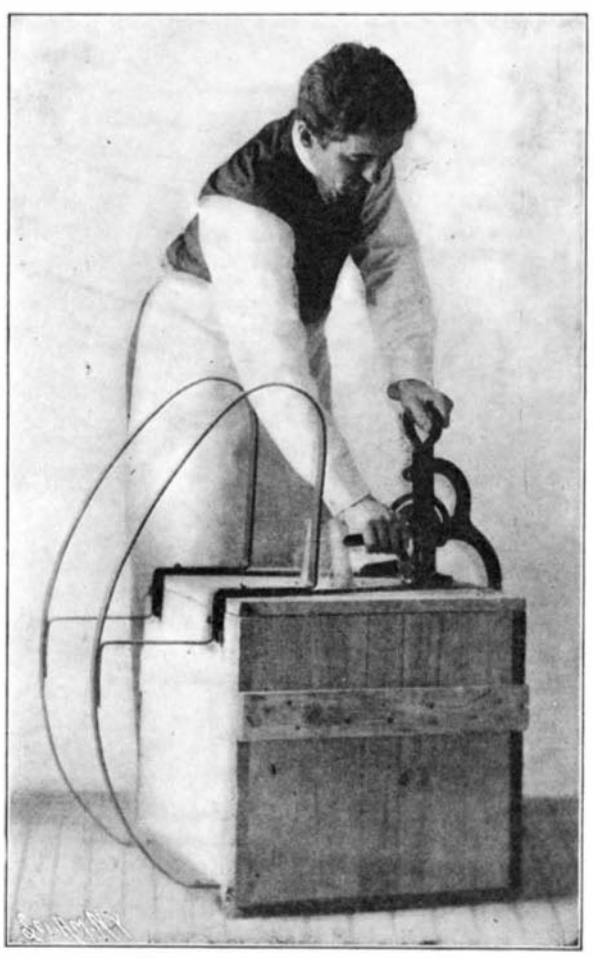
BY A. FREDERICK COLLINS.

For the protection of those who have to handle carboys of volatile fluids, such as nitric, sulphuric, muriatic, and other acids, the device here illustrated has proven an invaluable aid. It is known as the Flaherty carboy inclinator, and by its means a carboy may be tilted and its contents poured out at will, with the least amount of exertion and with absolute safety from spilling or splashing. A single movement only is required to lock the lever of the inclinator to the carboy; a pull on the handle then tilts the carboy and allows its contents to be poured out, when the carboy, by an ingenious curvature of the rockers, resumes its upright position.

Owing to the facility with which the inclinator may be clamped on or taken off, only one is required on a floor, which suffices for any number of carboys. The device works with a cam action, and clamps like a skate, it clutches the carboy firmly, and permits of



TILTING A CARBOY EQUIPPED WITH AN INCLINATOR.



APPLYING THE CARBOY INCLINATOR.

easy and safe handling, whether the carboy be full or contain but a gill.

The inclinator is strongly built, being made of iron throughout, and as all the cast parts are malleable, there is nothing to break or get out of order, and it should last a lifetime.

The North-Eastern Railway of Great Britain has considerably accelerated the express trains running over its system, in connection with the East Coast route between London and Edinburgh. The train which formerly left Leeds at 8:50 A. M. and occupied 4 hours 40 minutes to cover the 230 miles thence to Edinburgh, exclusive of stops, is accelerated by six minutes between York and Newcastle. This is a distance of 80 miles 48 chains, and it is now covered in 82 minutes exactly, an average of 58.97 miles per hour. This is a meritorious performance, since there are several severe gradients to be negotiated, while in running over the Durham viaduct and the high-level bridge at Newcastle-on-Tyne, speed in each instance has to be reduced to 15 miles per hour. In order to maintain the high average speed, the first 44¼ miles from York to Darlington is covered in 43 minutes, a speed of 61.7 miles per hour. In connection with the express leaving London at 5:30 P. M. for Newcastle, the distance between York and Darlington is covered in 44 minutes, a start-to-stop average speed of 60.34 miles per hour.

A Photographic Mailing Card.

Illustrated mailing cards are so much the vogue that collections of them are almost as common as stamp and autograph collections. A mailing card on which the amateur photographer may print his own pictures has been popular in Europe for some time, and is of considerable interest both for the photographer and his distant friends. It is quite easy to prepare. A common one-cent United States postal card may be sensitized in the following way:

Dissolve 5 grains of gelatine in 5 ounces of hot water and then add 50 grains of salammoniac. This solution must be filtered through a chemical filter paper or clean white blotting paper. It must then be put in a flat dish and the postal card floated in it, with the blank side down, for three or four minutes. The amount of solution specified will suffice for thus "salting" fifteen or more postal cards. Thus prepared, they will last indefinitely, but as soon as they are dry, they may be sensitized in the following bath:

Silver nitrate	50 grains
Distilled water	1 ounce

Float each card on this, with the blank or salted side down, for about three minutes, taking care that no fluid gets on the address side, and dry in the dark. Care must be taken to avoid air-bubbles. These sensitized cards will only remain good for a few days, so that it is not advisable to sensitize more than is required for immediate use. Print in the usual way in a printing frame, then wash and tone as directed below, then fix with a sodium hyposulphite solution, one part of the salt to eight parts of water.

For printing, an ordinary 3¼ x 4¼ frame will do if two adjacent corner pieces are knocked out so as to allow the card, which is 5½ x 3¼, to project without bending. The projecting end must be covered with a light-proof paper bag. In order to secure neatness it is often necessary to vignette the negative with a piece of opaque paper cut to the required shape. By this means it is possible to leave as much writing space as desired.

The following solution is used. The print is toned rather beyond the required color:

Sodium acetate	100 grains
Gold chloride	2 grains
Water	3 ounces

After toning the print is washed in water and fixed in the fixing solution given above. The card is finally washed in running water for about twenty minutes and dried.

Blue prints may be made on postal cards as follows:

Make the following solutions:

1	Ammonio-citrate of iron	1 ounce
	Water	4 ounces
2	Potassium ferricyanide	1 ounce
	Water	4 ounces

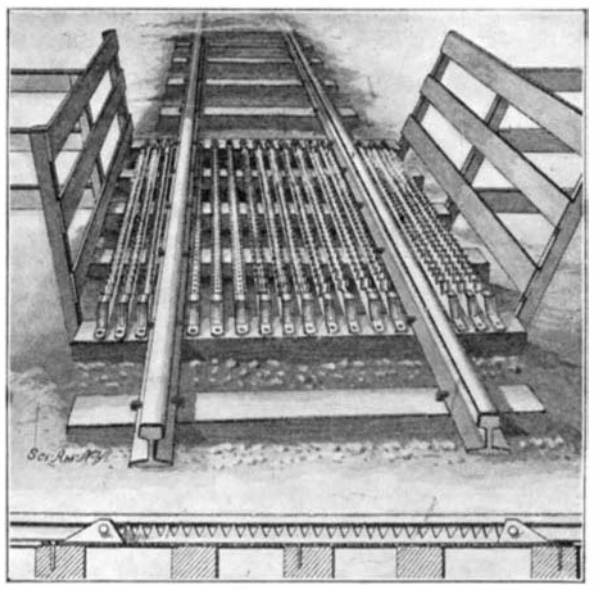
When ready for use, mix the required amount in equal proportions and apply to the surface of the paper with a sponge.

Print darker than the required print is to be and fix by washing in water until the high lights contain no trace of yellow. Although this is easier than the silver process it does not give such fine results. Whichever process is used, a negative with strong contrasts gives the best results.

AN IMPROVED CATTLE GUARD.

One of the principal objections to the cattle guards in general use, is that they are apt to present some obstruction to the passage of a chain or other member which may be hanging beneath a railway car, and when such a pendant member catches upon a portion of the cattle guard, the latter is almost certain to be greatly damaged thereby. Furthermore, in cattle guards as commonly constructed the parts are so connected that if any extensive damage is done, which would impair the apparatus to any considerable extent, it is necessary to remove practically the entire guard structure to repair it. We illustrate herewith a new form of cattle guard, in which the defects above noted are overcome. It is made up of a number of channel bars, which are independently secured to the ties with spikes. Each of the channel bars is beveled at the ends, and between the beveled portions the flanges are formed with teeth, as shown. The flanges are braced at the ends by blocks inserted between them. This makes it impossible for an animal to press a flange over to either side and render the teeth ineffective, as sometimes happens with guards constructed of the serrated plates commonly employed. Openings are formed in the bottom of each channel bar to provide drainage, and also to permit introducing the securing spikes.

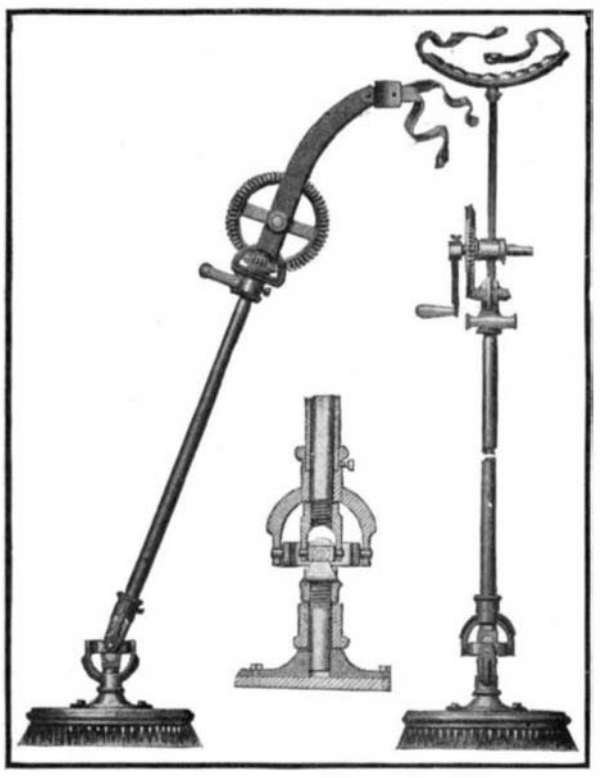
The proper drainage of the channel bars is important, as otherwise water would accumulate in them, filling them with ice in cold weather, and thus rendering the guards ineffective. Due to the beveled ends, the likelihood of the guards being torn up by a chain or the like depending from a car is very remote. In case, however, a guard is injured, it may be taken up without disturbing any of the others, and be straightened out or replaced with a new one. Mr. William Dobler, of Sumner, Wash., has just secured a patent on this invention.



IMPROVED CATTLE GUARD.

REVOLVING SCRUBBING MACHINE.

The ordinary method of scrubbing floors, that of getting down on one's knees and performing the work with a hand scrubbing brush, is very fatiguing. The use of a long-handle scrubbing brush, while less fatiguing, does not permit of as thorough work, owing to the fact that the necessary pressure cannot be well applied. A new method, however, has been supplied by the recent invention of Mr. William J. Tangerman, of Hammond, Ind. This invention consists of a revolving scrubbing brush, so arranged that the operator may exert any desired pressure to insure a thorough scrubbing of the surface under treatment. As shown in the accompanying illustration, the machine is provided at the upper end with a padded breastplate, which may be strapped to the body of the operator. The scrubbing brush is connected by a universal joint with a driving shaft, which passes up through a tubular member of the main frame. The tubular member is also connected by a universal joint with a sleeve on the spindle of the scrubbing brush. A bevel pinion at the upper end of the driving shaft meshes with the driving gear, which is mounted on the main frame, and rotated manually by means of a crank. A handle is formed on the tubular member of the frame, by which the scrubbing brush may be conveniently directed while in operation, the requisite pressure being at the same time applied by the body bearing against the breastplate. Owing to the universal joint connection between the frame and the bearing sleeve of the scrubbing brush, the brush is held at all times level and in proper contact with the floor.



SIMPLE MACHINE FOR SCRUBBING FLOORS.

THE MIETHE COLOR PROJECTOR.

BY OUR BERLIN CORRESPONDENT.

Prof. Miethe, of Berlin, has for some years been engaged in developing a process of chromo-photography, by means of which photographs are produced in the colors of nature. Three sections of the same photographic plate are exposed successively through three color screens corresponding with the three primary colors, red, blue, and yellow respectively. The times of exposure for the three screens must be determined by photographing a white object by daylight and varying the respective times of exposure, so as to obtain identical conditions of light and shade on each of the three plates. Instead of the colors named, Prof. Miethe prefers using blue, red, and green. By superposing on a screen projections of the three separate transparencies and interposing before each of these a color screen corresponding with the one used in making its negative, an image quite true to nature is obtained.

Special care has been devoted to the constructive development of the photographic apparatus, to the improvement of the photographic plates used for the purpose, and finally to the technical design of the projection apparatus. The intervals of time between the three exposures required for making the views have been reduced to a fraction of a second.

The most important point was, however, the development of a most perfect projection apparatus for the synthesis of the three views.

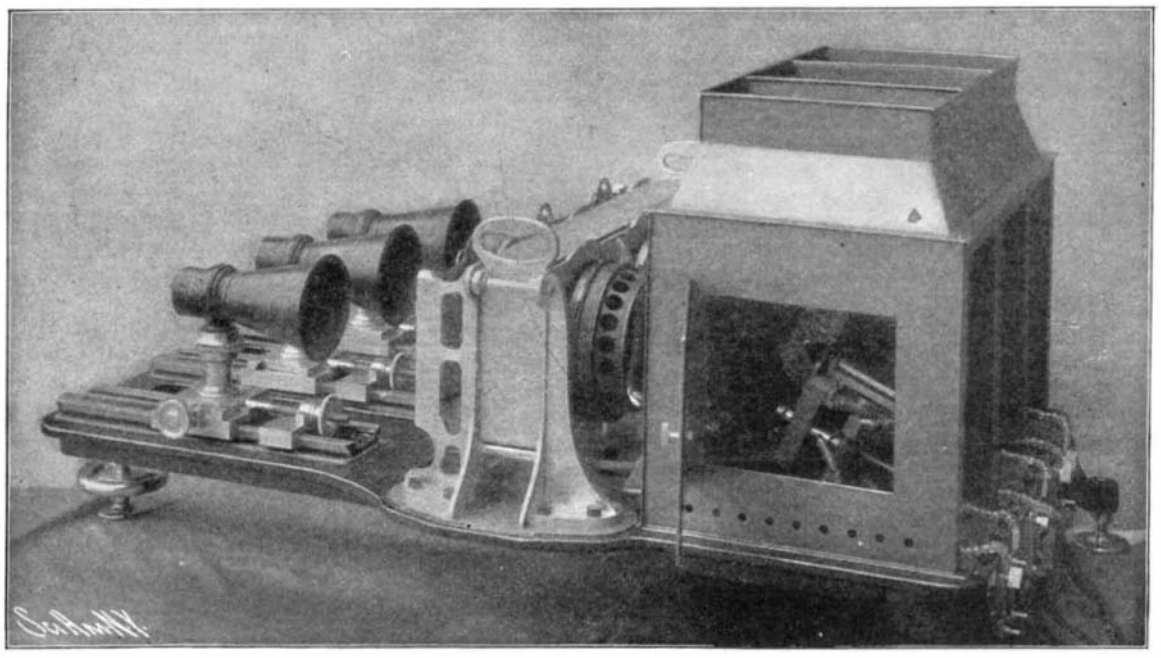
This projection apparatus has been constructed by C. P. Georz, and is being exhibited at the St. Louis Fair in connection with the German educational exposition. The effects of which these color photographs are capable have been increased by the intensity of the projector, which is represented in the accompanying illustration. In this apparatus the original principle of leaving the three sectional images on a common plate, also in projecting them, has been abandoned, thus insuring the possibility of a preliminary adjustment.

The projector consists of a triple lantern, inclosing three electrical arc lamps, to which the current is supplied, controlled from an ordinary switchboard. The current intensity can be varied between 10 and 35 amperes, thus flooding with an intense light screen surfaces of from 43 to 215 square feet. Each of the three condensing lens systems comprises three components, throwing the light pencils from the lamp with a convenient degree of convergence on the lantern slide and the projection lens. In order to utilize as perfectly as possible the sources of light, these condensing systems have been given an aperture ratio as great as possible; they are connected with a cooling vessel, common to all three of them and by whose absorption any heat rays that might endanger the slides are absorbed.

The projection objectives have been especially constructed for the purpose. Their focal lengths range from 30 to 50 cm. On the very substantial bed plate of the apparatus have been fixed the three optical benches, on which the projection objectives are made to slide and which are cast in one piece with the foundation plate and milled to the latter. In addition to the coarse and fine movement parallel to the optical axis of the three objectives, the lateral objectives can be independently adjusted both horizontally and vertically. The adjustment to the center of the projection screen is effected by the foot screws of the apparatus.

For adjusting the partial images, an aluminium frame is used into which three rectangular apertures have been cut at convenient distances one beside the other. Instead of effecting this adjustment in the apparatus itself, a special adjusting apparatus has been constructed, similar to a dividing engine, on the carriage of which two displaceable and rotating microscopes have been so arranged that the sections of their cross wires may be made to coincide with any point of the central sectional image. These points are next transmitted to the two other partial images to the right and left, and after having been accurately adjusted, the diapositives are screwed fast in the adjusting frame. The adjustment of the images thus ensured is extremely accurate and remarkably stable. The partial images will be projected accurately on the same portions of the projection screen, thus insuring perfect coincidence.

The color screens located in front of the objective consist of plate glasses glued to each other, between which the colored layer has been inserted. As a shutter has been provided between the diapositives and the objective, the filters are exposed to the intense light from the lamp only for the time they are actually used, thus warranting a much greater durability.



A NEW STEREOPTICON FOR REPRODUCING PICTURES IN THE COLORS OF NATURE.

RECENT AUTOMOBILE AND MOTOR-BOAT SPEED RECORDS.

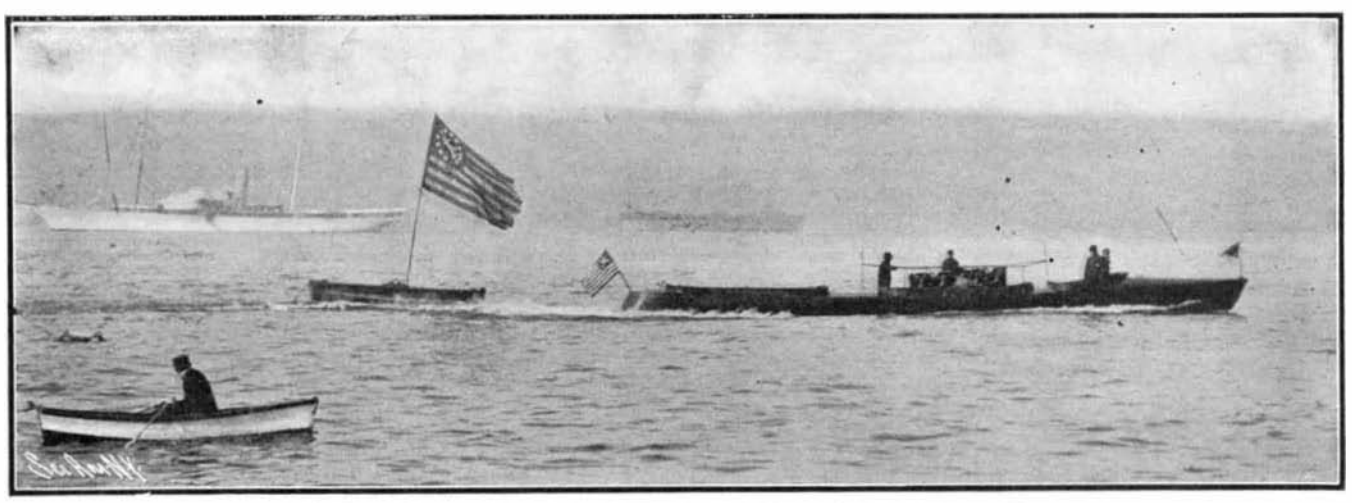
Now that the racing season of the year has closed, it is interesting to note the speeds that have been attained on track and stream by those modern space annihilators—the automobile and the motor boat.

At an international match race run in two heats and a final on the Empire track October 29, Barney Oldfield, on the 60-horse-power Peerless racer, illustrated herewith, made a new set of figures for 10 miles in competition from a standing start, and completed the distance in the record time of 9 minutes, 12 3-5 seconds, or at an average speed of 65 miles an hour.

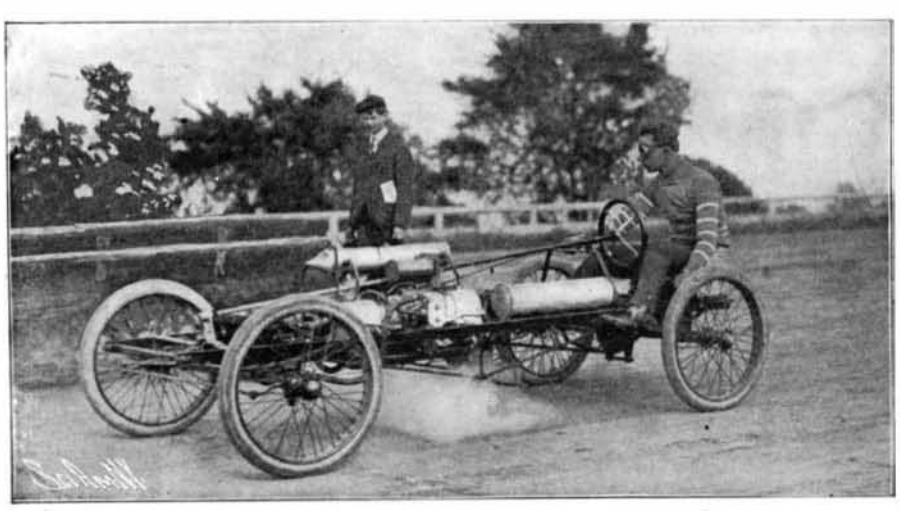
The first heat was between Thery, on the 80-horse-power Richard-Brazier racer with which he won the Bennett cup race last June, and Sartori on Mr. A. G. Vanderbilt's 90 horse-power Fiat racer. This heat was won by the latter car in 9:45 4-5, Thery taking exactly 10 minutes to cover the 10 miles, and Sartori making the first 5 in exactly 5 minutes also.

The second heat was between Mr. W. Gould Brokaw's 60 horse-power Renault racer and Oldfield on the Peerless, and was won by the latter by a margin of 24 4-5 seconds in 9 minutes, 20 seconds. Bernin, who drove the Renault, made the first 5 miles in 5 minutes, 2-5 second, and his time for the 10 miles was 9: 44 4-5. Oldfield covered both the second and third miles in 53 1-5 seconds, and his time for the first 5 miles was 4:41.

Oldfield won the final from Sartori by 27 1-5 seconds in the record time of 9:12 3-5, which is 2-5 of a second faster than the best time for 10 miles with a flying start. He drove the car splendidly, and it ran with all the steadiness of the foreign cars, besides having much greater speed. Our

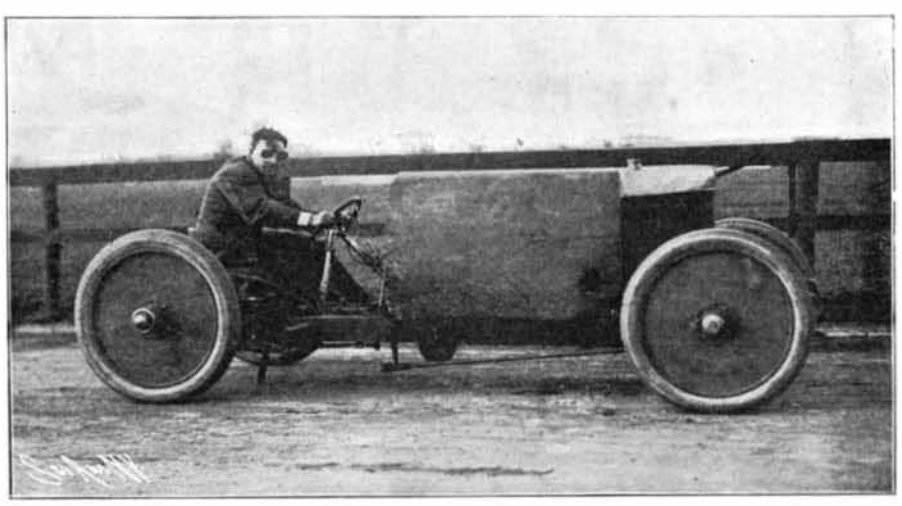


175-Horse-Power Motor Boat "Onontio" Making 28.42 Miles an Hour.



Frank Kulick on the 20-Horse-Power Ford Racer.

Record: 1 mile in 55½; 5 miles in 4.43⅘, which is equal to 63.47 miles an hour.



Barney Oldfield on the 60-Horse-Power Peerless Racer.

Record: 1 mile in 52⅕; 10 miles in 9.12⅘, which is equal to 65.14 miles an hour.

RECORD-HOLDING AUTOMOBILES AND MOTOR BOATS.

illustration gives a good idea of the appearance of car and driver. The machine is the second racer the company has constructed this year. It is distinguished by a sharply-pointed bonnet, the front end of which is formed of the vertical radiating tubes, and by disk wheels, which decrease the air resistance and keep stones from flying up into the machine. These wheels are of the ordinary wooden-spoked artillery type, 34 inches in diameter, and suitably covered, which gives them the appearance of disks. The car is fitted with a four-cylinder vertical 5¾ x 5¾ engine having 75 pounds compression, and geared so as to drive the car 60 miles an hour at 725 R. P. M. The machine is fitted with but two speeds, and a bevel gear drive is used at the rear axle.

Another racer to make new records is the Ford light-weight car, which we also illustrate. This machine weighs but 875 pounds. It consists simply of a frame on which are mounted two 10 horse-power opposed-cylinder engines coupled together and direct-connected with the rear axle by a chain and metal expanding-shoe flywheel clutch. The bore and stroke of the cylinder and pistons are 4 and 4½ inches respectively, the compression used is 90 pounds, and the motor will speed up to about 1,600 R. P. M. as a maximum. It differs from the regular Ford motor only in having the valves in the head instead of in a valve chamber at the side. Driven by Frank Kulick, this machine made a new set of records for light-weight cars (551 to 881 pounds) by covering 5 miles in 4:43 3-5. The fourth and fifth miles were made in 55 1-5 seconds. The best records for middle-weight (881 to 1,432 pounds) cars—one mile in 59 seconds and 5 miles in 5:01—were therefore substantially lowered.

The Ford racer also defeated the 60 horse-power Renault and the 90 horse-power Fiat at the Empire track on November 8. The Renault was beaten by 1-5 second, the time for the 5 miles being 4:48 2-5.

Of the other track records for 1904, the Peerless car shown holds that for 15 miles (time, 14:05), while Winton machines have to their credit the records for 25 and 50 miles, the times for these two distances being 23:59 and 55:42 respectively.

The fastest mile covered on a track this year was that made by Barney Oldfield with the Peerless racer at Denver, Col., on the 5th instant, when, in making a 20-mile record in 18 minutes and 45 2-5 seconds, he covered an intermediate mile in 52 1-5 seconds. Earl Kiser, on the Winton Bullet, had made on September 10 a record of 52 4-5, which was thus reduced 3-5 of a second by Oldfield, who attained a speed of 68.96 miles an hour, as against Kiser's 68.18.

People residing near the Hudson River have had several opportunities to witness some lively motor-boat races within the last two months. We have shown the latest models of these speed craft as they appeared in racing trim. Our illustration this week shows the motor boat which holds the world's record for the fastest mile. This is Commodore Harrison B. Moore's new 60-foot boat "Onontio," fitted with a 175 horse-power Craig engine, which drove it through the water a distance of one nautical mile in 2 minutes, 26 seconds, or at the rate of 24.66 knots or 28.42 statute miles an hour. This fast speed was attained on the Hudson River over a nautical mile laid out and measured by United States naval officers; and the remarkable performance of the "Onontio" was the feature of the day on October 29, when a match race was run between Mr. Frank Croker's "XPDNC" (short for "Expediency") and the "Challenger" and "Vingt-et-Un II." of Messrs. Smith & Mabley. This race was run on the Hudson from New York to Poughkeepsie and return—a total distance of 118.6 nautical or 136.6 statute miles. The "XPDNC" won in 5 hours, 11 minutes, 50 seconds, which represents an average speed of 22.86 nautical, or 26.29 statute, miles an hour. She covered the first half of the course in 2 hours, 30 minutes, 50 seconds, at an average speed of 23.62 nautical, or 27.17 statute, miles an hour, which is extremely fast for so long a distance. The "Vingt-et-Un II." was obliged to stop several times, which reduced her average speed for the entire course to 19.26 nautical, or 22.15 statute, miles an hour, her elapsed time being 6 hours and 10 minutes. The "Challenger" was disabled at the start, and so did not run. Both this boat and the "Vingt-et-Un II." were fitted with S. & M. engines of 119 and 59.72 horse-power respectively, their lengths being 39.62 and 38 feet on the waterline, and their ratings, under the rules of the American Power Boat Association, 88.35 and 79.35. The rating of the "XPDNC" is 79.7; she is fitted with a Mercedes engine of 47.6 horse-power; and she is 44 feet long on the waterline.

The hull of the "Onontio," which was designed by Mr. Henry J. Gielow, is 60 feet over all and 57 feet 11 inches on the waterline. The beam is 7 feet, and the draft 1½ feet, the extreme draft being 3 feet. The keel and framing are of oak, and the planking is double, of ⅜-inch mahogany on the outside and 5-16-inch white cedar on the inside. Both layers of planking run fore and aft, and have the space between them filled with a special cement. A novelty is found in six water-tight bulkheads of two thicknesses of 5-16-inch white cedar crossed diagonally and laid in cement. Another special feature is found in two fore-and-aft trusses, which make a firm bed for the engine and greatly stiffen the hull. There are three cockpits —one for the helmsman, another for the motor, and a rear one for passengers. The motor is made up of eight 7¾ x 10-inch individual cylinders, arranged in two groups of four each. The cylinders are mounted on ⅞-inch vertical steel rods, ten of which support each set of four cylinders. The crank shafts are not inclosed, but revolve in bearings in the base plate below the cylinders. Both the crank shafts and the connecting rods are hollow. There is a separate crank shaft for each group of cylinders, the two being connected together by a clutch which also acts as a flywheel. By disconnecting the forward part of the engine, the boat can be run on the rear group of cylinders only. The valves are located in the heads of the cylinders, each of which contains two inlet and two exhaust valves, all mechanically operated. Make-and-break igniters, supplied with current from a dynamo, are used, and a force-fed mechanical lubricator supplies oil liberally to all the bearings. The motor was designed by James Craig, Jr., to give 175 horse-power at 650 R. P. M. Its weight is 3,500 pounds. In the speed trial mentioned above, it is said to have turned up 900 R. P. M., in doing which it made 3,600 explosions per minute, and the propeller (which is a three-bladed, 30-inch diameter, reversible screw having a maximum pitch of over 5 feet and covering a helicoidal path of 10 feet per revolution) covered at its edges more than a mile and a half a minute.

Launch of the "Caledonia."

A new steamer for the Cunard Line, the "Caledonia," intended for service between this country and the River Clyde, has been launched. This new liner measures 515 feet in length by 58 feet beam, and 36.6 feet deep to the tonnage deck. The displacement is 16,000 tons. The "Caledonia" is built with a straight stem and elliptical stern, with two steel pole masts of fore-and-aft schooner rig, and two funnels. There are six decks —the 'tween, main, upper, bridge, promenade, and boat decks. The ship is divided into nine watertight compartments. Accommodation is provided for 300 saloon passengers on the main and bridge decks. The main saloon is fitted on the upper deck with the library, placed immediately above on the bridge deck. The promenade deck is 230 feet in length, sheltered by the boat deck, and in turn shelters the bridge deck, which is of a similar length. The second-class passengers, for whom there is accommodation for 400 persons, have their quarters amidships toward the stern of the vessel, with staterooms on the main deck. The third-class passengers, 800 of whom can be carried, are accommodated on the main and 'tween decks. The "Caledonia" is propelled by two sets of triple-expansion marine engines of the latest pattern, with cylinders measuring 31½ inches, 51½ inches, and 85 inches bore, respectively, and a 4 foot 6 inch stroke. The boilers are of the best Siemens-Martin steel, and consist of four double-ended and four single-ended boilers, respectively, with 48 withdrawable furnaces, yielding an aggregate heating surface of approximately 30,000 square feet. Special attention has been devoted to the freight-carrying capacity in this steamer. As the exportation of machinery in bulk comprises such an important item of the exports of this country, the "Caledonia" has been provided with specially large hatches to facilitate handling, and the cargo will be manipulated by ten horizontal winches, which have been specially designed for use upon this vessel.

Hobart College, at Geneva, N. Y., and Dr. William R. Brooks, Professor of Astronomy in the college, have both been signally honored at the St. Louis World's Fair. The International Jury awarded a bronze medal to Hobart for its general educational exhibit representing all departments; and a special gold medal for the astronomical department, prepared under the direction of Prof. Brooks. The distinguishing feature of the astronomical exhibit is a collection of photographs of all the comets, now twenty-four in number, discovered by Prof. Brooks. Eleven of these comets, as many of our readers know (for all of Dr. Brooks's discoveries have been immediately reported and described in the Scientific American) were discovered at the Red House Observatory, and thirteen at the Smith Observatory, a total number exceeding that of any other living astronomer.

The Canadian government, in appropriating large amounts for railroad subsidies for new lines during the past year, has imposed a new condition, viz., that the companies receiving subsidies must use steel rails made in Canada, provided the same can be secured at reasonable prices and of a suitable quality.

Automobile Notes.

Following the example of other sovereigns of Europe, the King of Spain is becoming a chauffeur, and has lately ordered several cars from Paris which are to be built specially for him. The cars will be constructed by the Panhard & Levassor firm. On the other hand, it is reported that the Emperor of Annam, Ton-Taï, is learning to pilot a car, and this led him to adopt the European costume. He has also a mechanic, but as the national custom does not allow a subject to take a place at the side of his sovereign, the mechanic is obliged to sit on the footboard of the car.

The hill-climbing race which was held at Chateau-Thierry (France) on the 24th of October brought out no less than sixty-three touring cars having a total value of $200,000. Nearly all of them climbed the steep road (one mile distance) at high speeds. The winner made a speed of 1 min. 42 sec. for the mile, which represents about 35 miles an hour up the slope of 10 per cent. A Mercedes car, piloted by De Larentie-Tholosan, made the above speed, and many of the others nearly equaled it. The motor bicycles distinguished themselves in this event and nearly reached the speed of the automobiles. Collomb, mounted on a Magali wheel, made the climb in 1 min. 43 4-5 sec., closely followed by three others. In all, there were 13 motor cycles that finished in times ranging up to 3 min. 15 sec. In the category of cars valued at less than $800, Barreaux made the best time on a Bolide car, or 3 min. 11 1-5 sec. In the $800 to $1,600 class, a Serpollet car took first place in 2 min. 38 sec. Serpollet also won the $1,600 to $2,400 class in 1 min. 52 sec., coming not far behind the winning Mercedes car, which belonged to the class above $5,000, and the same cars came first in the $2,400 to $3,600 class, in 2 min. 1 sec. It will be seen that the steam-operated cars are still holding up well as regards speed.

Recognizing the need of thoroughly trained chauffeurs, the West Side Young Men's Christian Association of this city, aided by the Automobile Club of America, has opened an automobile school for owners and chauffeurs. Three courses are to be given, the first consisting of popular illustrated lectures on steam, gasoline, and electric automobiles, which will be delivered by Charles Edward Lucke, Ph.D., director of experimental engineering in Columbia University; the second, on the design and drafting of motors and their accessories as well as the various methods of transmitting power to the wheels; and the third, practical operative work, consisting of instruction in the operation of machines, and lectures and demonstrations on their dissection, with the machine as a working basis. The second course will be taught by Amasa Trowbridge, adjunct professor of mechanical engineering, Columbia University, and a recognized authority on machine design, while the third course will be under the direction of Mr. Clarence B. Brokaw, an expert on automobiles, who will devote his entire time to the instruction of the new class. So popular has the third class become that no more pupils can be received for the present. It is calculated that three months' instruction will be sufficient to complete the chauffeur's education, and so a new set of pupils will be started in this class on February 1. Applications for the second class in operating work should be made at once by those desirous of entering. The opening lecture in the first course of the automobile school was given on the evening of November 9, by Winthrop E. Scarritt, president of the Automobile Club of America. Mr. Scarritt congratulated the members upon their entering upon this new line of study, and he thought that members of the industry, and all automobilists also, were to be congratulated on having so many intelligent young men take up the study of automobiles. He spoke briefly of the three typical kinds of machines, and gave the would-be chauffeurs several good pointers on their operation. He specially drew their attention to the necessity of always being ready to make a quick stop in case of emergency, and told them above all things to thoroughly master their machines. He thought that the automobile would ultimately solve the problem of congested city streets, since it could do twice the work in half the time required by the horse-drawn vehicle, and since it only occupied about half the space at that. He said that it was a startling fact that although we have increased facilities for the transportation of the masses, not until the appearance of the automobile has there been any improvement in the transportation of the individual during the past four thousand years. He thought that the time would yet come when the workingman would own his own machine, and would reside in the country and go back and forth in his own vehicle every day to his work. Mr. Scarritt's address was an able presentation of the automobile and automobilism as we find it to-day, and, as can be seen from the examples cited, he is most optimistic as to what the machine will do for the individual of every class in the future.

Correspondence.

The Thylacinus Cynocephalus.

To the Editor of the SCIENTIFIC AMERICAN:

I notice two letters in your last issue relating to the *Thylacinus cynocephalus* and the three specimens of the animals on exhibition at Washington. The trouble is caused by the inadvertent omission of the words "adult male" in the copy sent you of the original MS. The specimens at Washington, female and two young, are well known. J. CARTER BEARD.

Brooklyn, N. Y., November 4, 1904.

Remarkable Clock with Automata.

From the "Lexikon der Uhrmacherkunst" we take the following description of a curious clock of recent date:

The clock was made by one Christian Martin, who lived in the Black Forest, Germany, and is contained in a cabinet 3.02 meters wide, 2.72 meters high, and 0.55 meter thick.

The face, or front of this clock, is divided vertically into seven sections, and each of these into five smaller sections or frames, displaying in all thirty-five frames, in each of which there is some movable thing.

Upon this multiple face one may read the seconds, the minutes, the hours, the days, the weeks, the months, the four seasons, and the common and leap years. Harmonious music accompanies the movement of each object. Situated in the center of the front is the time-dial or clock-face proper. An angel at the bottom of the central section tells off the minutes on a gong. In the central frame of the third section are two figures of which one strikes the quarters, while the other, with the finger of her right hand, points to the quarter just struck, providing in this way a visible as well as an audible signal. The lowest frame of the same section displays successively the figures of an infant, a youth, a full-grown man, and a person of ripe old age, corresponding with the quarter struck, intending thus to exemplify the four ages, instead of the time-honored seven ages of man's life.

Death, in the third frame of the fifth section, sounds the full hour. As soon as the hour is struck, the twelve apostles appear in an oval frame just above the clock-face, one after the other, each saluting Christ, who is placed in the frame directly above them, and receiving a blessing from Him. After playing their part they withdraw from view, and a cherub guards the doorway.

The day of the month is shown on the dial in the second space of the third section. The maker computed the leap-years up to the year 99,999. The days of the week are marked by mythological figures which appear in the top frame of the third section. The twelve signs of the zodiac, corresponding to the twelve months of the year, are also shown in the topmost frame of the fifth section.

The Moon displays her various phases in the circular frame just below the time-dial. Beginning with 10 P. M., a trumpeter industriously announces the hours upon his trumpet till 4 A. M., when he is relieved from duty by a cock that stands perched upon a pedestal in the next frame. With the dawn the cock, true to its nature, flaps its wings and crows. Across the front in the fourth frame of section six we see a soldier, who heralds each new year with an air played upon his bugle. In section one of the bottom frame we see an old bell-ringer, whose duty it is to sound the hours of 6 A. M., 12 M., and 6 P. M., the hours of prayer. An old beggar in the frame next on the right reminds us of our *devoirs* by kneeling, and with folded hands supplicating the Deity. At the last stroke of the bell he rises, and the scene of action is transferred across the board to an organ grinder, who grinds away, accompanied by a clown and bell in the adjacent frame. The uppermost frames in sections 1, 2, 6 and 7 show the fourteen scenes in the Passion, while the second frames of sections 1 and 7 show the seven days of the creation.

The Current Supplement.

The English correspondent of the SCIENTIFIC AMERICAN opens the current SUPPLEMENT, No. 1507, with a very thorough and finely illustrated description of a universal 300-ton testing machine. J. C. Barclay describes some modern high-speed printing telegraph systems. Mr. L. Ramakers presents a very full description of the Siemens-Halske printing telegraph. His text is excellently illustrated by some handsome photographs and line drawings. Dr. Caird recently read before the Royal Philosophical Society of Glasgow a paper on the developments in means of communication by sea during the nineteenth century. The paper is published in the current SUPPLEMENT. The St. Louis correspondent of the SCIENTIFIC AMERICAN writes instructively on Germany at the Fair, his article being accompanied by some photographs especially taken for us. "Utility of Automobiles for Military Operations" is the title of an article which gives much valuable information on a subject of considerable interest at the present time. Capt. William W. Harts contributes a well-illustrated article on the debris-restraining barriers of the Yuba River.

Electrical Notes.

The emanation produced by radium has been frequently investigated, so that many of its properties are known; the question as to whether the particles consituting this emanation are charged or not, seems, however, not to be definitely solved, though a solution of the same would be necessary for obtaining an adequate idea of the decomposition of radium atoms. In an article published in the Physikalische Zeitschrift, Mr. J. A. McClelland examines as accurately as possible whether the emanation bears an electric charge, as would seem to be the case according to Rutherford's work. It is definitely shown that such is not the case, this being of the greatest bearing on radium theories. As radium atoms are sure to give off positively-charged particles (being the alpha-rays) the emanation particles cannot possibly be the remainder of the atoms left by one or several alpha-rays, as in that case the emanation should be negatively charged. The atoms therefore must have given off a negative charge of the same magnitude, either by an emission of negative particles or in any other way.

The favorable experience gained in connection with the use of storage batteries in telegraphic service induced the German Telegraph Department very soon to utilize the advantages of accumulator operation also in connection with telephone service, when no appreciable difficulty was encountered in telephone exchanges. As regards, however, the use of accumulators as microphone current sources in subscribers' stations, special experiments proved necessary, accumulators being discharged there rather slowly, with small currents and at great intervals, so as to give rise to self-discharges and sulphating of the plates. In the Elektrotechnische Zeitschrift, Mr. L. Brückmann records some preliminary experiments made by imitating the conditions of service in a much-used subscribers' station. As no drawbacks were met with at first, these experiments were extended in January, 1895, to the practical service, thirty-six subscribers' stations being fitted with storage batteries of the Böse system. The following conclusions may be drawn from the behavior so far shown by these storage batteries: Though the working of the accumulators as far as their resistance against shocks, oxidation of the terminals, etc., was concerned, had proved rather satisfactory, the condition of the plates was found to be frequently worse than the electric behavior would have warranted. There is a risk of sulphated cells being taken in operation again, such accumulators being subject to complete destruction. Apart from this, however, the charging of microphone accumulators requires much more time and work than that of accumulator cells in normal operation, every cell having to be treated separately. Moreover, different conditions would obtain for different types of cells, so that different kinds of accumulators cannot be connected in a common charging circuit (in series). On the other hand, the initial advantages of accumulator operation for telephone service have lost much of their importance because of the introduction of improved microphones. No further extension of storage battery operation was therefore made by the Telegraph Department.

In a note recently communicated to the French Academy of Sciences, Mr. A. B. Chauveau records an interesting observation on electric dispersion made by himself during the thunderstorm of August 4, and which goes to confirm a result enunciated by the experimenter in a previous memoir on the thunderstorm of July 24. After a very hot and beautiful day, during which the heavens had been very clear, without any other indication of a forthcoming thunderstorm than the appearance close to the sun of some clouds toward 6 o'clock, the thunderstorm, which was not anticipated up to 6 h. 30 m., was seen clearly in the west toward 6 h. 45 m., and moving with an extraordinary rapidity, arrived at the Eiffel Tower five to six minutes afterward, with a waterspout and whirlwind. The darkness that arose suddenly did not allow of any measurements being made, but the author noted at some minutes' interval on one side an extremely rapid dispersion of positive electricity, and on the other a negative dispersion, which was about normal and rather small as compared with the former. The positive dispersion was such that the leaves of the electrometer approached one another visibly, as under the influence of a flame or a strongly radioactive substance, so that the author would have supposed a leakage in the instrument, if the negative dispersion tested immediately afterward had not shown its ordinary behavior. In the course of the afternoon, in fact, without any interruption from 2 h. 30 m. to 6 h. 30 m., dispersion measurements were made, which did not present any anomaly in fair weather, the negative dispersion remaining constantly more rapid than the positive. The mutual ratio of the two dispersions would even show a decided increase, passing from 3.3 (at 3 h.) to 4.9 (at 5 h. 30 m.). The thunderstorm inverted abruptly this ratio in a doubtless much stronger proportion. Taking into account the violent rain during the two observations of July 24 and August 4, the most likely hypothesis for explaining these considerable negative charges carried along by the air would be to consider them as an analogous phenomenon to the well-known phenomenon observed in the neighborhood of waterfalls.

Engineering Notes.

The production of bituminous coal in the United States last year was 285,000,000 net tons, an increase over 1899, five years ago, of 94,000,000 tons, and an increase over 1893 of 155,000,000 tons, or much over 100 per cent.

The "Forward," the first of a series of scout warships to be built for the British navy, was successfully launched on October 27. The "Forward" is 384 feet long and 39 feet beam, and her engines will develop 16,500 horse-power, giving a speed of 25 knots, with a crew of 290. She is intended to search for a possible enemy, and convey quick information to a squadron.

June 23 was the hundredth anniversary of the birth of August Borsig, who may be called the Matthew Baldwin of Germany. Beginning as a carpenter, he as a man learned drawing and mechanics in a trade school; became foreman of a foundry; started one himself; developed it into a machine shop; turned out his first locomotive in 1841 and his five hundredth in 1854, and died a few months later.

A new coal wharf is being constructed between Marola and Cadimare, Italy, for the convenience of vessels discharging cargoes for the Italian navy, and for bunkering men-of-war. Steamers will be able to lie alongside and discharge direct on to the trucks of the wharf, instead of as heretofore being obliged to lie off and discharge into lighters. This new wharf will, it is hoped, greatly expedite the clearance of British colliers, but it is to be regretted that the improvement will only affect vessels with cargoes for the Italian navy.

In the French motor car championship hill-climbing competition, which took place on the very long and severe ascent of the Ventoux mountain, several fresh records were made. The distance was 13½ miles, and in the class for heavy cars the time taken by the winner was 21 min. 12 sec., beating the record by 3 min. 38 sec. By the voiturette cars the time taken was 29 min. 59 sec., creating a fresh record of no less than 13 min. 36 sec. better than the previous record. The ascent is one of the stiffest in France, and the times show an extraordinary improvement on last year's meeting.

A new type of fuel has been devised by two gas engineers of Southend, England, the outcome of several years' patient investigation and experiments. The fuel is manufactured from what has hitherto been considered a waste product of chemical manufacture. This fuel is intended to supplant the asbestos or fire-clay balls which are at present utilized in gas-stove fires. It absorbs the blue Bunsen flame, which at present escapes, and converts it into heat. It also absorbs the carbonic oxide from the air, thereby considerably purifying the atmosphere, has no smell, burns brightly as a coal-fire, and, owing to the materials of which it is composed, is cheaper to produce than either fire-clay or asbestos balls, while the substance is also practically inexhaustible. The fuel also has the quality of retaining the heat for a considerable time, and, when ignited, gives three times as much heat as is possible with the asbestos or fire clay, with the same consumption of gas.

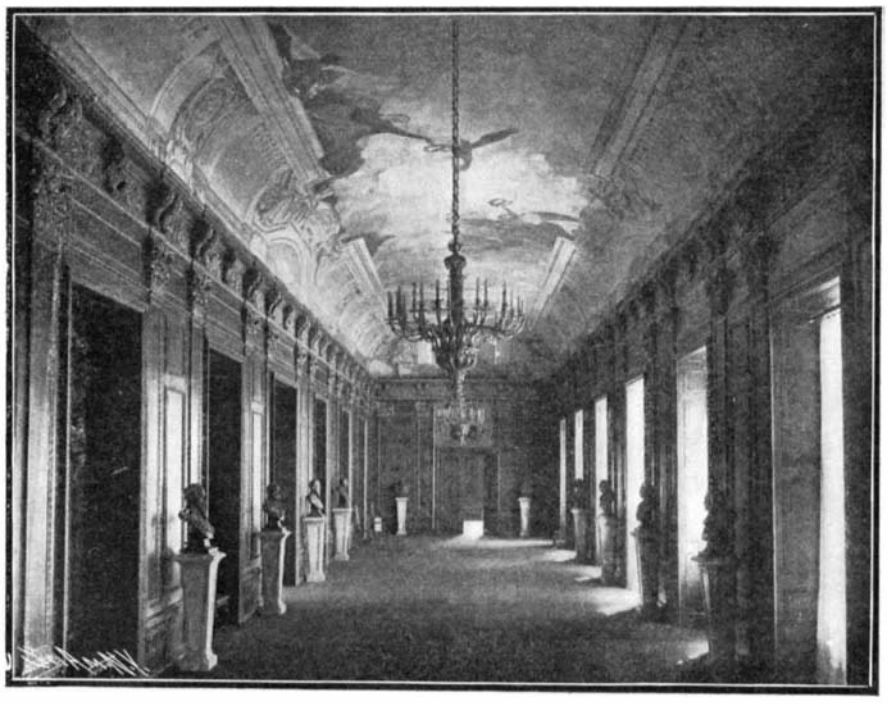
The highest tunnel in Europe is undoubtedly that of the new Jungfrau electric line which is to reach the summit of the mountain. According to recent reports the tunnel, which is now in construction, has passed the altitude of 3,000 meters (1.8 miles). As the road is entirely underground after reaching the altitude of 2,400 meters (1.04 miles) it may be safely affirmed to be the highest tunnel in Europe. The work, which commenced over ten years ago, is very slow. The second station, that of Rothstock, was opened to the public on the 2d of August, 1899, and the third, the Eigerwand station, not until the 1st of July, 1903. The next station, that of Mer de Glace, will not be opened before next summer, and perhaps only during 1906. The great length of time needed for the construction lies in the fact that the rock is especially hard and it is impossible to use quick-working drills. What is favorable is that there has been no water flow up to the present, as is the case in the Simplon tunnel. Until now the workmen have not suffered from the high altitude, but physicians fear that they may contract the mountain disease when they reach the higher points. It is estimated that it will be ten years before the road finally reaches the summit of the Jungfrau.

THE GERMAN NATIONAL PAVILION AT ST. LOUIS.

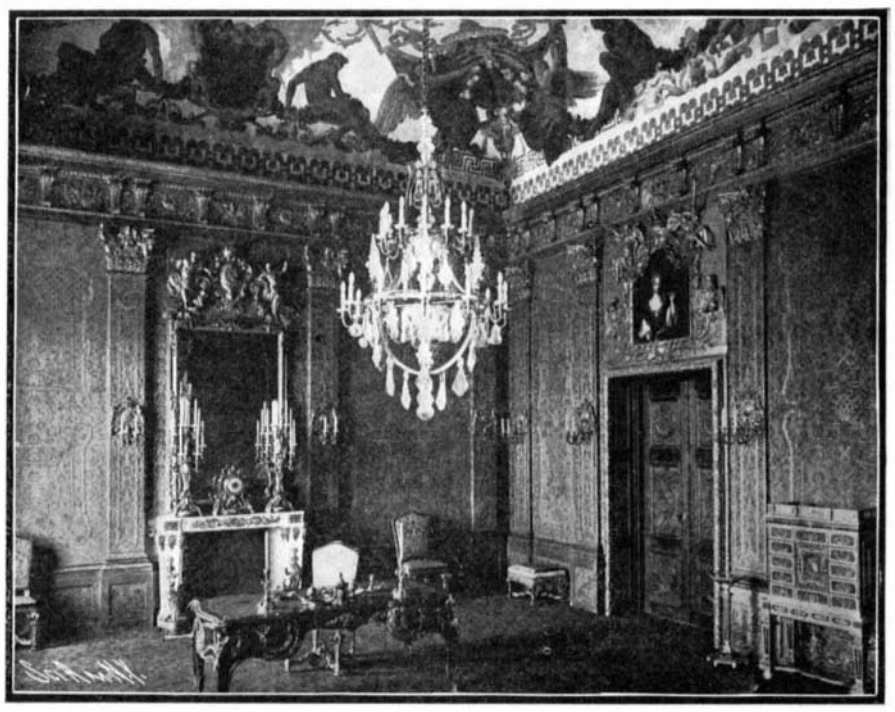
Among the forty or more nations which are participating in the Exposition at St. Louis, Germany was fortunate in securing the finest site that was reserved for any foreign exhibitor. The National Pavilion stands on a plateau to the east of the amphitheatre, which is crowned by Festival Hall and the Colonnade of States. It overlooks the Cascades and Cascade garden to the west; to the south of it stretches the long façade of that beautiful structure, the Mines and Metallurgy Building; and with the dark green of the woodland as a background, its fine proportions are shown up with a distinction and emphasis that must be very gratifying to the sons of Germany. It was a happy idea of Emperor William, under whose oversight the plans were prepared, to make this pavilion a partial reproduction of a building which is as conspicuous in German history as the building itself is prominent in the World's Fair grounds. The pavilion is copied with fidelity from the central portion of the famous castle at Charlottenburg near Berlin. The castle itself was built near the end of the seventeenth century by Frederick I., the first King of Prussia. It was designed by Andreas Schleuter, the great German architect of that period. It is at once apparent from the photograph herewith reproduced, that the architecture of the Charlottenburg castle is imposing. The main façade is in three stories. In the center above the main entrance, towering over 150 feet skyward, is a lofty dome. The façade of the first floor is in rustic stone; the second and third floors are enriched with twelve Corinthian columns. In the center, beneath the shadow of the great dome, is a projecting bay crowned with a classic pediment. The drum of the dome is pierced by eight lofty windows, and it is marked by a Corinthian colonnade, the columns of which are slightly taller than those of the stories beneath. The curve of the dome is broken and relieved by circular windows, while its summit is crowned by a lofty lantern, surmounted by an heroic figure, whose gilded form may be seen flashing in the sunlight from any portion of the Fair grounds. Surrounding the pavilion are gardens that are accurate reproductions of those around the original castle.

Reproduction of the Central Portion of the Palace of Charlottenburg.

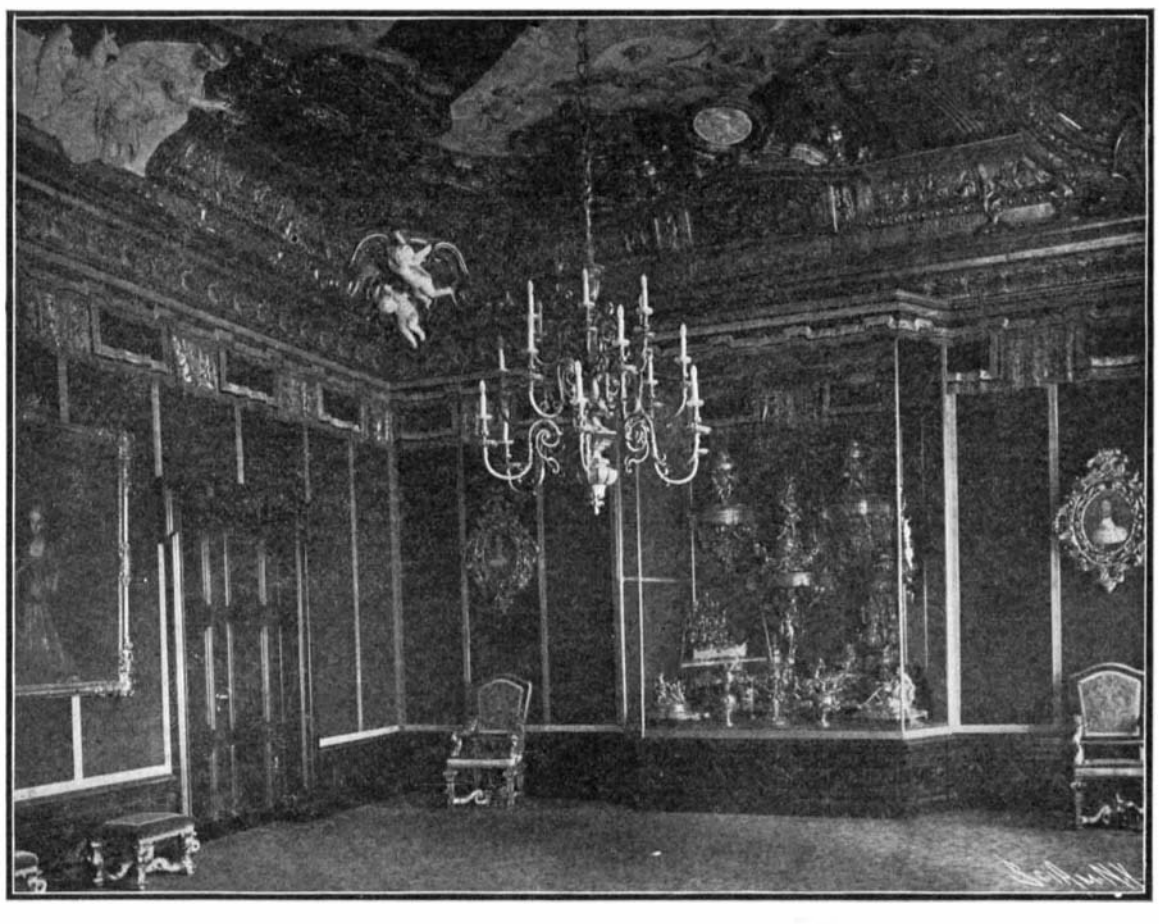
Much of the interior of the pavilion is a faithful reproduction of the Charlottenburg interior. Perhaps the most imposing room of all is the spacious oak gallery, the doors and wainscoting of which are an exact reproduction of the original, as is the richly-decorated ceiling. Down each side and at each end of the room are busts of the Hohenzollern family, and on the walls is a portrait of Queen Charlotte, after whom the palace was named. Another handsome room herewith illustrated is the Brandenburg room, which contains the actual palace furniture, brought over from the room of the same name in the German palace. Imperial portraits adorn the walls, and at one end is a large glass case containing the silver and gold wedding presents of the German Emperor. Another display of the royal furniture is made in the Galloon room, over the entrance door of which is a portrait of Queen Christine, the mother of Frederick the Great. In the same building are the offices devoted to the various chiefs of the German Commission. Last and by no means least among the notable features of this structure is the peal of bells in the tower belfry, which is rung at stated



The Oak Gallery, Containing the Busts of the Hohenzollern Family.



The Galloon Room, Containing Furniture Loaned from the Charlottenburg Palace.

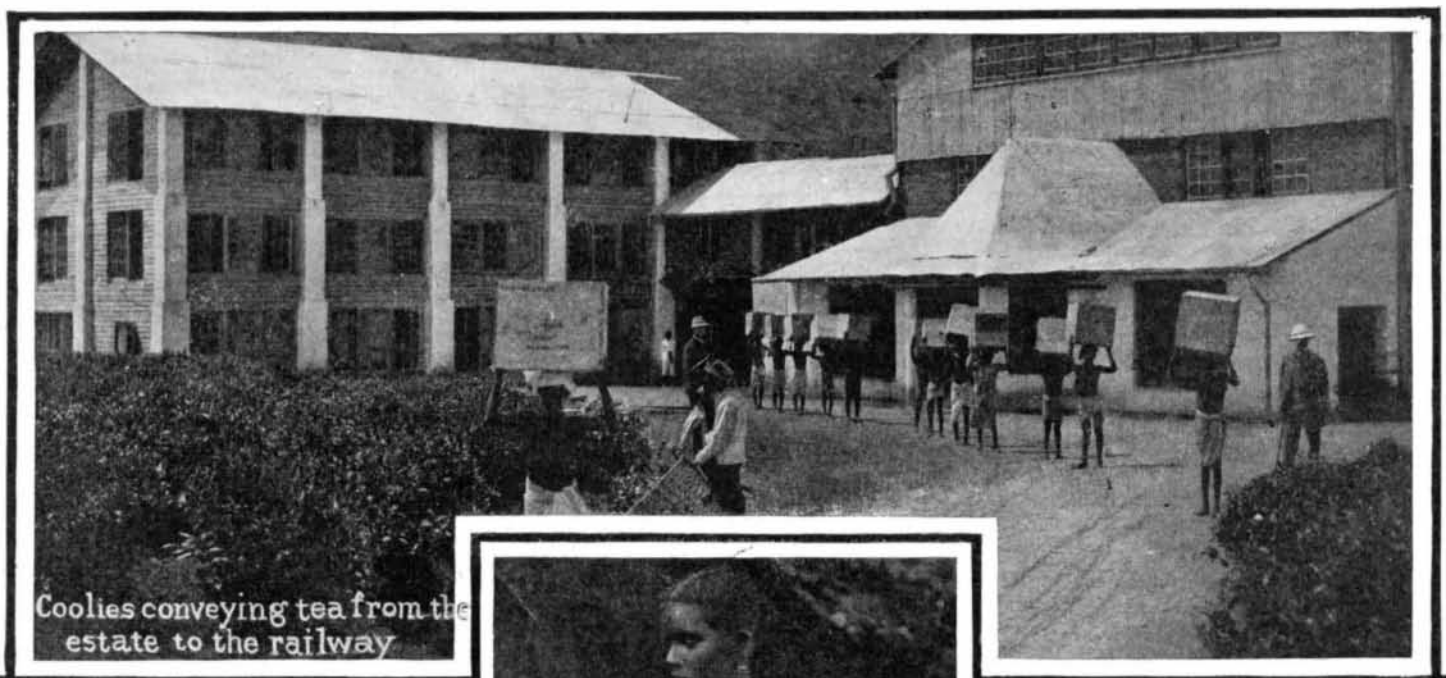


The Brandenburg Room, Showing in Case the Gold and Silver Wedding Presents of the German Emperor.

THE GERMAN GOVERNMENT BUILDING AT THE ST. LOUIS EXPOSITION.

hours of the day and evening. The tone of these bells is exquisitely sweet, and strongly reminiscent of the sweet chimes that may be heard floating from any old cathedral tower in Europe. The marvel of these bells, however, is that they are constructed entirely of cast steel; for the German maker, thanks to his perfect knowledge of the chemistry and furnace treatment of metals, has learned to so manipulate the steel, that it will produce when cast into bells (as this peal at the World's Fair amply demonstrates) tones that are just as sweet as those of the more costly bell metal with which we are familiar. The peal on exhibition has been purchased by one of the large Eastern cities, and three other sets have been ordered in this country.

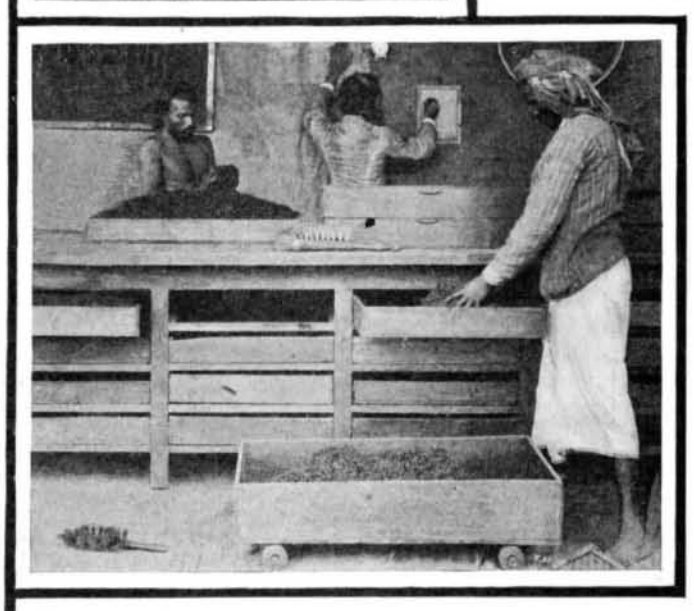
In the current issue of the SUPPLEMENT will be found an illustrated article dealing with the German exhibit as a whole, with detailed descriptions of the various sections in the exhibition palaces.



Coolies conveying tea from the estate to the railway

Planting Tea.

A Tea Plucker.



Preparing the Tea for Rolling.

THE CULTIVATION OF TEA IN CEYLON.

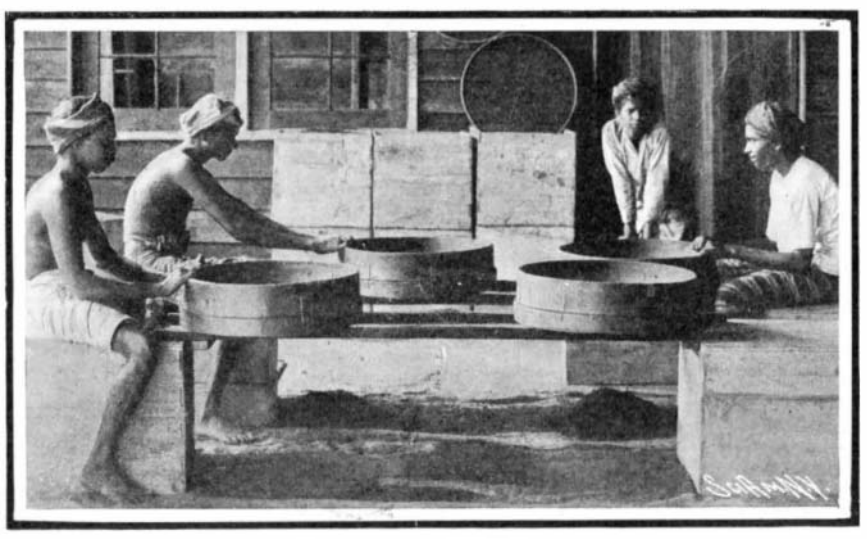
BY CHARLES C. JOHNSON.

Ceylon tea's steady advance in popularity in the United States and Canada calls attention to the strong contrast between the methods of preparation of tea in Ceylon and in China and Japan. In the latter countries the work is done to-day in the same fashion as a century ago, largely by hand. In Ceylon machinery is utilized wherever possible, and the entire process of preparation has become largely mechanical. In both China and Japan individual tea cultivation is very general. As the season for harvesting tea approaches, native representatives from the tea interests, whose headquarters are in the cities, visit the growers, and ascertain how much tea they will have for sale and the price they expect to receive. In this way small lots of tea are sold, ranging from fifty to two hundred and fifty pounds, according to the extent of the land under cultivation. Teas thus purchased are taken to one of the large cities and placed in factories, where they are often refinished, after which they are graded and mixed with other lots of tea received at market in the same manner.

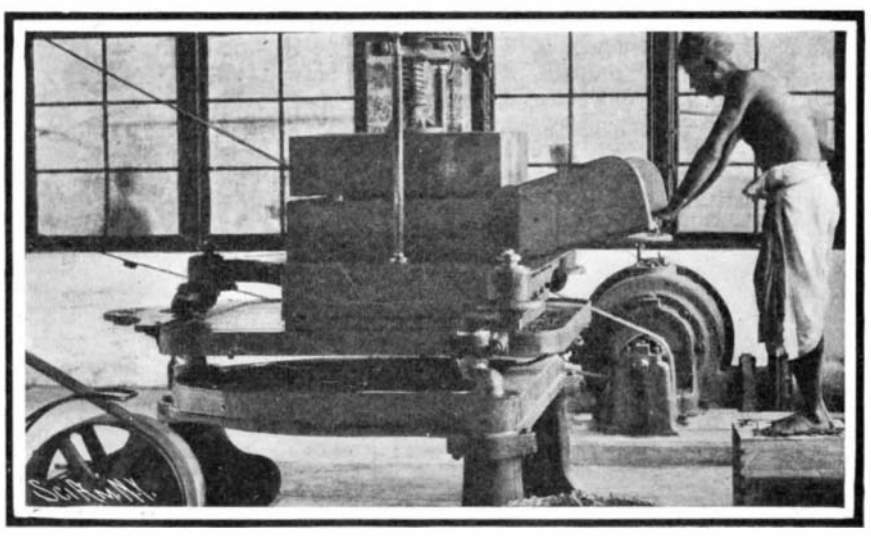
Packing Tea in Chests.

In Ceylon, the system is wholly different. Land has been purchased, and is placed under cultivation to an extent of hundreds of acres at the same time. A factory is constructed and equipped with modern machinery suitable for rolling and firing teas, and affairs are managed according to European business methods. A superintendent is placed in charge of the estate, with from one to two thousand natives to perform the labor, for the care of whom he is responsible to the government.

The tea seed, having been carefully selected, is sown as soon as possible, as it quickly loses vitality. It is tended, shaded and watered, for the young plant is an object of tender care until it goes through the process of transplantation. When once established, it requires cultivation until three years old, at which time it is plucked, and at the end of the season pruned.



How the Tea is Sifted.



Tea-Rolling Machinery.

THE SCIENTIFIC CULTIVATION OF TEA.

The process of manufacture commences with plucking. The bushes having been pruned and cultivated throw out vigorous fresh growths, and these in turn put forth shoots and leaves called by planters a "flush." The smaller shoots on each side of a flush are what is taken from the plant at each picking. These are described as two leaves and a bud.

Plucking is performed by women, who pass down between the lines of bushes, plucking the young leaves and dropping them into the baskets they carry. Their energies are stimulated by the fact that their daily pay is regulated by the weight of leaf they bring in, and they are checked from plucking old leaf by minus marks being placed against their names for any large leaf found in a basket.

After being weighed in, the leaf is taken to the withering room, usually placed so as to have the heat from the engine room. Here it is spread out in thin layers on the lattice-work shelves with which the room is fitted, to wither or wilt until the excess moisture evaporates. Were this not done, and were the leaf put through the next stage as it came from the bush, full of moisture and sap, it would be so brittle that it would break into fragments. In the course of the night the leaf is sufficiently withered, and is then soft and flexible, and can be twisted without snapping.

When sufficiently withered, the leaf is passed down waiting chutes to the rolling tables. There are various patterns of machines, but the principle is the same in each, viz., two plane surfaces, revolving one over the other, somewhat after the fashion of millstones, but with a freer swinging action, so as to roll and not grind the leaf. The faces of both the upper and lower tables are of wood, and the leaf is rolled under sufficient pressure to give it the desired twist without breaking it.

The process of rolling having broken open the leaf cells, facilitates the chemical changes which follow, and which are grouped together and termed fermentation by planters. These changes are very obscure, and have not been subjected to searching chemical analysis. So far as appearances go, the most important of these is oxidation. The leaf being taken from the rollers is still more green than any other color. At this stage it is spread out, and soon assumes a copperish brown color, due to oxidation.

The fermented leaf is then spread upon trays, and passed into closed machines, of which there are several patterns. But, as in the rollers, the principle is the same in each—to fire the tea by exposure to a suitably regulated current of hot air, drawn through the machine by means of fans. This process corresponds with "pan" and basket firing, but the firing in modern factories does not allow the leaf to be subjected to the direct heat of the fire, and the temperature can be regulated to a nicety to attain the end without destroying the essential qualities of the leaf.

Next is the final stage, the whole process after the leaf is withered occupying less than two hours with modern machinery. Up to this stage all the leaf as brought in by the pluckers has been treated together; but as each of the leaves and the bud represent different qualities and differing values, it is now necessary to separate them. This is done by means of graduated sieves, made to oscillate by means of a pulley.

The "tip" in varying proportions, with some of the leaf nearest to it, makes Orange, or Flowery Pekoe, of proportionately varying values; the small leaf makes Pekoe, with which a small quantity of "tip" remains. The large leaf makes Souchong, and the mixture makes Pekoe Souchong. Broken Orange Pekoe, etc., are simply the broken leaves of their respective qualities, and are preferred by some consumers. In the sorting process some dust and fannings are also separated.

When sufficient tea has been collected to form a "break," it is refired at a low temperature, to get rid of any moisture absorbed from the atmosphere, and packed at once in lead-lined boxes, when it is ready for market.

Successful tea cultivation in Ceylon dates from 1841, on the Rothschild estate. Several specimens of the tea plant were imported from China that year. Successive experiments proved satisfactory, and resulted in the tea produced being pushed in the European markets. In 1877, 2,000 pounds of tea were exported from Ceylon. Now many millions of pounds are exported annually to England alone. Ceylon tea is similar in almost all respects to India tea, and the product of these two countries has practically displaced the teas of China and Japan in England.

Many persons believe that the history of Ceylon tea in England will repeat itself in the United States, but if it does the result will be of far less importance to the tea industry. English people drink tea as the Americans do coffee. In Canada the situation is much the same. In the northern sections of the United States tea is popular, although much less favored than coffee, and here, within the last five years, the Ceylon "greens" or green teas have made considerable headway in the displacement of the green teas of Japan and China, principally the former, for our annual importation of green teas from Japan exceeds 40,000,000 pounds. In the Southern States the relative consumption of tea is small, a fact noticeable in all sections whose climate is of a tropical or semi-tropical nature.

Indirectly, the war between Japan and Russia militates against the teas of the former country, from which our principal supply of green teas comes. Recruiting for the Japanese army has sadly depleted the skilled labor utilized in the preparation of Japanese teas. The inevitable result of insufficient skilled labor, coupled with an effort to keep the quantity produced from lessening, is a coarsening of the tea leaf, a fact likely to have an ultimate effect on sales in America, to the benefit of Ceylon teas.

A very large proportion of Ceylon teas received in the United States comes *via* England. The teas are shipped in bulk from Ceylon to England, where they are rehandled, blended, and put up in various-sized packages, both for export and home consumption. Some of the Ceylon tea planters favor a direct market in the United States and Canada, and are striving to find means for its establishment.

THE WATER ORGAN—A ROMAN KEYBOARD INSTRUMENT.

BY THE REV. F. W. GALPIN, M.A., F.L.S.

As we watch the fingers of the pianist flying over the compass of his instrument, or sit entranced by the wealth of harmony which the organist commands as he touches his manuals, seldom do we realize how much curious history and laborious ingenuity lie hidden within those rows of black and white keys. To tell their tale would require a volume; perhaps a sketch of their later development may be given in a subsequent paper. At present we are concerned with a period anterior to the production of the modern keyboard, and we are to deal with an instrument practised and admired by Greeks and Romans.

A Roman keyboard instrument! The title sounds absurd, for do not our textbooks assure us that the keyboard was invented in the eleventh or twelfth century of our present era? Yet, owing to a discovery made among the scattered ruins of Carthage, we are able not only to state positively that the use of keys was well known to the ancients, but also to reproduce a working model of the instrument whereof they formed so interesting and important a part.

Around the *hydraulus*, or water-organ, a great mystery is supposed to hang, and more than one learned writer has confessed himself unable to understand it or to explain its principle and construction; while others have made wild guesses at the purpose for which the introduction of water was required. We hear of "boiling" water and the steam rushing through the pipes of the organ, or we read of "bubbling" water designed to give a weird, tremulous effect to the sounds produced. All such like guesses are quite unworthy of the subject, for there still exist two ancient treatises which upon careful study explain the whole principle of the instrument.

The hydraulus was invented by Ctesibius of Alexandria some time between 300 B. C. and 250 B. C. Probably long before his day a rudimentary form of organ existed, evolved from the syrinx or from the bagpipe; but to this celebrated mechanician belongs the credit of first applying the water principle to the instrument and of adding those little levers, now termed "keys"; for, as Philo of Byzantium (c. 200 B. C.) affirms, it was Ctesibius who invented "the kind of syrinx played by the hands which we call hydraulus." This great work was minutely described by his own pupil Hero in his book entitled "Pneumatica" (ch. 75), and about 15 B. C. Vitruvius in his treatise "De Architecturâ (Book X.) gives us another full account of the instrument as he knew it. From these two writers we learn that the water was used for the same purpose as that for which the modern air reservoir is now loaded with heavy weights, namely, to give that compression to the air inside the wind chest of the organ which is necessary to make the pipes "speak" properly and to prolong the sound during the process of refilling the bellows or "feeders." Nor would there have been any mystification at all on this point, but for an irreparable loss. Both the aforenamed writers allude to drawings and designs accompanying their descriptions, and in both cases the originals are lost, such designs as are given with the texts of these authors being either due to the imagination of the editors or to the suggestions of a lingering tradition. The form of hydraulus is delineated, it is true, on medals and in mosaics; but the outlines are rude and indistinct, and only one part of the organ is fully shown—the part away from the player, which we should call the back of the instrument, but which the Romans considered and decorated as the front.

There exists, however, in the Museum of S. Louis at Carthage, near Tunis, a small representation in baked uncolored clay of an hydraulus and its player. The model—7 1-16 inches in height and 2¾ in breadth—evidently portrays some distinguished organist and his instrument. It was made by a potter named Possessoris, who has placed his name on the front of the wind chest. From other works by the same hand it is known that he lived during the early part of the second century A. D.

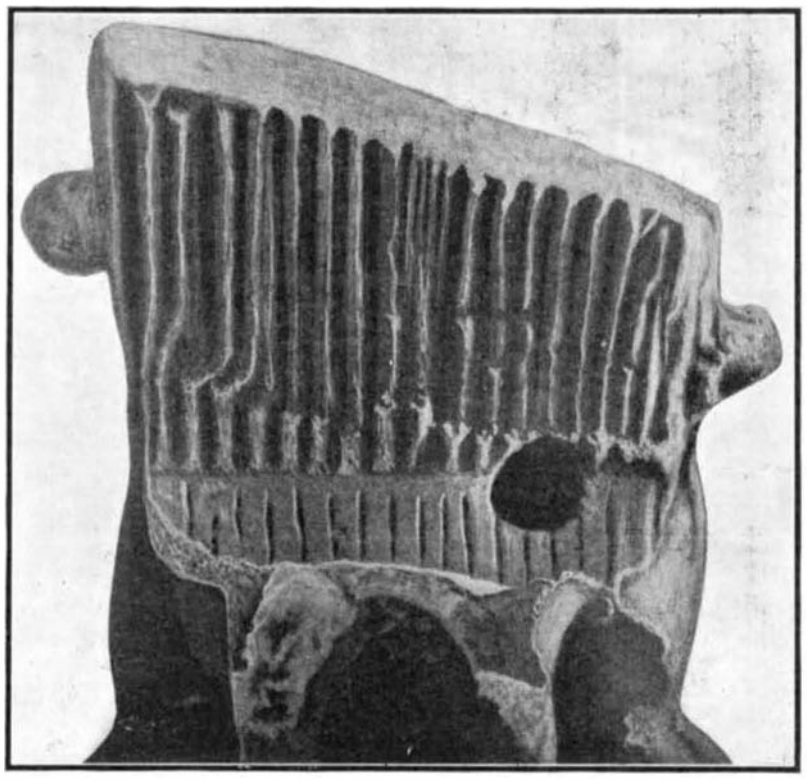


Fig. 3.—Enlarged View of Keyboard.

Now this little model gives us a perfect view of the shape and outward construction of the water organ at the height of its popularity. We can examine it on all sides, and as the details have been most scrupulously represented, we have been able, with the aid of Hero's and Vitruvius' explanations to construct a complete working reproduction of the instrument. For the photographs of this valuable relic here shown (Figs. 1 to 4) we are much indebted to the Rev. Père Delattre, the learned curator of the museum, while the remaining illustrations and diagrams give some idea of the writer's own working reproduction.

On referring to Figs. 1 and 5 and Diagram I (letter *K*), there will be seen in the lower center of the organ the water box, an altar-shaped reservoir containing the water and, except for a movable lid, open to the air at the top. On either side are the air pumps (*A*), barrel-shaped structures each fitted with a wooden plunger (*B*) in which is a small valve (*C*) for admitting air when the plunger falls. This form of valve is well described by Vitruvius, and has been copied in the reproduction from one remaining in part of a Roman fire engine now in the British Museum, London. It occurs again in the wind chest at *F*. In the air pumps or "feeders" described by Hero and Vitruvius the actual valve is of a different form; in the first instance, a flat plate placed inside the top of the barrel and kept in position by two pins, and, in the later description, a metal disk with a central boss (cymbalum) rendered more sensitive by a counterpiece sometimes fashioned like a dolphin. Across the top of the water box is the wind chest *G*, and above it at either end will be noticed in the pottery model (Fig. 1) two large holes. These are due to the exigencies of the potter's art, and supported two short sticks of wood or clay to represent the long handles of the blowing levers. These levers were in reality centered on either side of the organ, as will be seen in Figs. 5 and 6, where one plunger is shown drawn up (see also Diagram I, *D*). This position was evidently an improvement on the earlier design, in which (according to our authors) the levers were centered on separate uprights inserted into the base of the organ, the plunger being therefore pushed up the barrel instead of drawn up, as in the present instance. We know that many alterations were made in the instrument from time to time; and even the Emperor Nero, who would have shown himself an adapt performer on the hydraulus at the public games, had circumstances permitted, busied himself during the last days of his precarious existence in discussing and suggesting further improvements. Inside the water box (*K*) there is an inverted bell or funnel of metal (*J*) raised off the bottom by little feet, so that when

the water box is half filled, the water finds its way also inside the inverted bell and rises to the same level. On depressing the handle of the air pump, the plunger (*B*) is raised and the air is forced out of the barrel (*A*) through the pipe *E* and the valve *F* into the wind chest (*G*); being unable to escape or to return, owing to the closing of the valve, it passes down the pipe (*H*) into the inverted bell (*J*) standing in the water. As the pumps are rapidly and alternately worked, the air forces the water out of the bell (*J*) into the water box (*K*), but the superincumbent weight of the expelled water compresses the air both in the bell and in the wind chest above. In the working model the water rises 3½ inches in the water box when the bell is emptied, and this is the pressure of the wind in the organ; but constant care has to be taken by the blowers to maintain the water at about the same level. If there is too much air in the bell or compressor, it finds its way out at the bottom and bubbles up through the water, giving the "boiling" effect noticed by ancient writers.

Fig. 1.—Front View of the Hydraulus.

Fig. 2.—Rear View of the Hydraulus.

Fig. 4.—Side Views of the Hydraulus.

Above the wind chest is a cross channel (*N*) running immediately under a row of pipes; in the reproduction there are three rows of pipes, and so three parallel cross channels. Above the channels again is fixed the "sound board," as organ builders term it, consisting of an upper and a lower board, through both of which are pierced vertical holes communicating with the pipes above. Between the two boards are inserted small sliders of metal called "regulæ" (*P*) pierced with holes corresponding to those in the sound board (●); but in their normal position their flat surfaces, which are well oiled, close the outlets (see Diagram II.). Each slide is terminated at one end by a wooden head (●) to prevent its passing in too far; and at the other end it is attached by a short iron hook (*S*) to the lower point of the key lever (*T*) which is centered (at *V*) on a short pin. By depressing the key (*T*) with the finger the slide (*P*) is pushed into its groove as far as the regulating pin (*R*) when the holes correspond exactly with the openings in the sound board, and the compressed air passing up from the wind chest below causes the pipes to sound. A metal spring (*V*), as described by Vitruvius, brings the slider back again to its normal position when the finger is removed. In the organ of Hero's day a horn spring with a gut attachment was used for the same purpose. The sliders of the working production have been copied from some found among the parts of a small organ discovered at Pompeii and now in the museum at Naples. The form of the key levers is distinctly shown in the pottery model and in the enlarged view of the keyboard (Fig. 3). The hole observable on the right-hand side is probably the spot to which the hand of the pottery organist was affixed—his legs fortunately still remain in position on his elevated seat. From these the true scale of the original instrument has been worked out. Its height was about 10 feet and its width 4½ feet as shown in the diagrams. The front row of pipes, which is the best preserved, shows nineteen in number, and the keyboard, when perfect, consists of nineteen keys, each about 8 inches long and 2 inches wide. On one side of the instrument as represented by the potter there are slight indications of the stop handles. These stops, which are carefully explained by Vitruvius, are like small taps (see Diagram I, *M*) and admit at will the compressed air into the various cross channels (*N*). (Diagram II., in which the right-hand stop is shown open.) These have been modeled on specimens of Roman taps still existing.

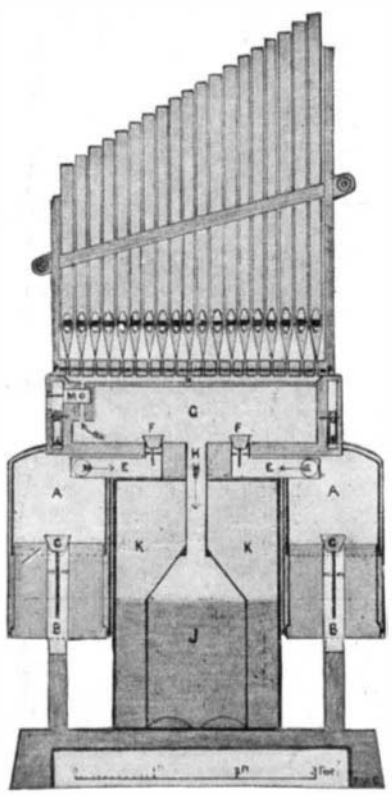


Diagram I.

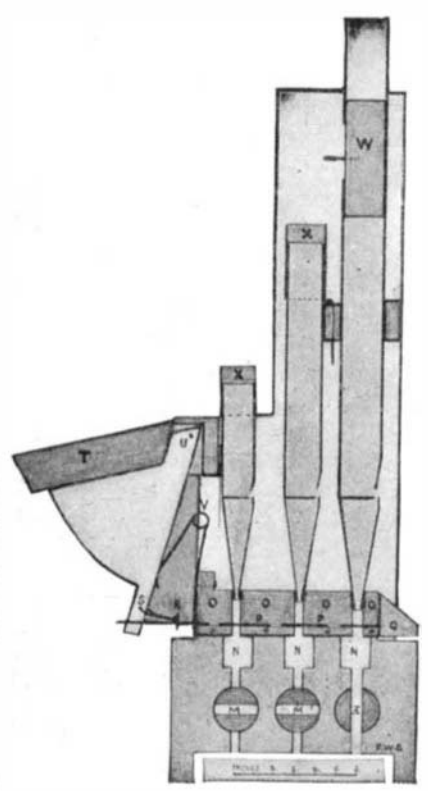


Diagram II.

A difficult and intricate question was the pitch of the pipes and the scale of notes they gave. Fortunately an anonymous Greek writer of the second century A. D. tells us that the hydraulus players used but six out of the fifteen recognized scales or "tropes," and that these were the Hyperlydian, Hyperiastian, Lydian, Phrygian, Hypolydian, and Hypophrygian—the first and last being an octave apart. Following the generally accepted standard of pitch, and placing the last five of these scales together, the following series of sounds are required:

G A B♭ B♮ c d e♭ e♮ f f♯ g g♯ a b♭ b♮ c′ c♯′ d′ e′

nineteen notes for the nineteen keys of the organ, the highest or Hyperlydian scale being played on the octave stop. The front or unison pipes are stopped as in the ordinary syrinx, and fitted with regulating pins (as at *W*) suggested by the remains of some organ pipes found at Pompeii. The other two rows, which are pitched as octave and superoctave, are open pipes and furnished with sliding rings (*X*), which are described by several Greek writers, though probably they were in this case only used for tuning purposes, the intricate changes of tonal systems being at this date no longer in use. It will be observed that the pipes are all of the same diameter, a peculiarity also found in the pipes of the Pompeiian or-

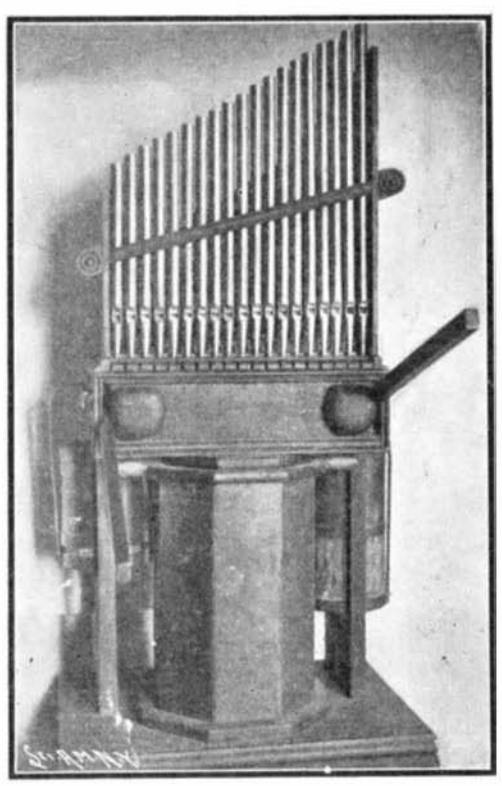


Fig. 5.—Front View of the Working Reproduction of the Roman Hydraulus.

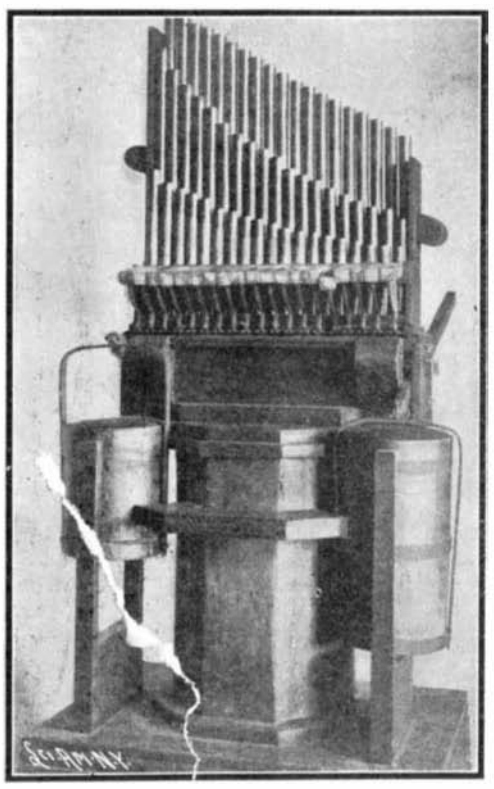


Fig. 6.—Rear View of the Working Reproduction of the Roman Hydraulus.

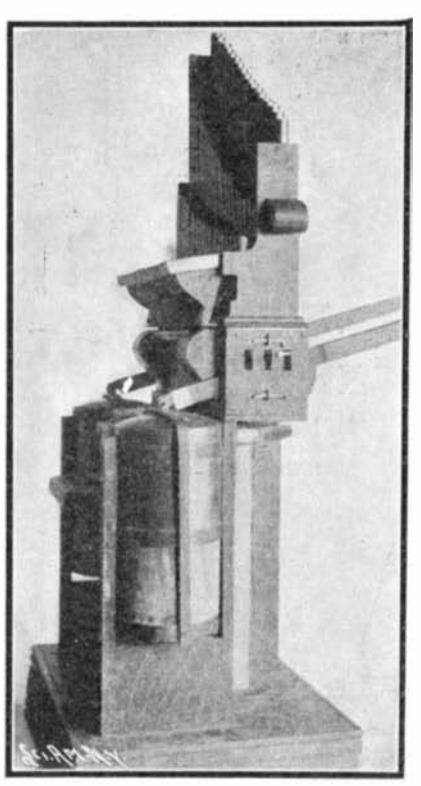


Fig. 7.—Side View of the Working Reproduction of the Hydraulus.

MODEL OF A WATER ORGAN FOUND AT CARTHAGE.

gan at Naples. To place the water organ side by side with our magnificent modern instruments would be as unfair as it would be absurd. More than two thousand years divide them, but that the hydraulus can still afford pleasure was conclusively shown at a demonstration given lately in London, when the ancient Greek music in use at the time the pottery model was made (such as the Ode to Chronos and the Hymns to Nemesis and Kalliope) was rendered in the original language with hydraulus and kithara accompaniment to the enthusiastic appreciation of a large audience.

In classical times the water organ was the admired adjunct of the public games and the luxurious theaters. Its association with the orgies of pagan Rome and the contests of the gladiators did not recommend it to the Christians. With dying Rome, it died; and those ingenious devices of keys, stops, and other details were lost until at the close of the eleventh century musicians astonished the men of their day and generation with a newly-found keyboard—a rough and rude contrivance indeed when compared with the "light touch" and "varied strains" of the old hydraulus.

The Inevitable Ether.

In an article which Miss Agnes Clerke writes in Knowledge on "The Inevitable Ether," and which is remarkable no less for its brilliant summary of the modern theories of the "ether" than for the literary fastidiousness with which it is written, the steps by which the conclusion that mass and energy may be interchangeable are traced. "The glory of the heavens is transitory," writes Miss Clerke, "but to the very brink of that mysterious ocean the science of the twentieth century has brought us; and it is with a thrill of wondering awe that we stand at its verge and survey its illimitable expanse. The glory of the heavens is transitory, but the impalpable, invisible ether inconceivably remains. Such as it is to-day, it already was when the *Fiat Lux* was spoken; its beginning must have been coeval with that of time. Nothing or everything according to the manner in which it is accounted of, it is evasive of common notice, while obtrusive to delicate scrutiny. Its negative qualities are numerous and baffling. It has no effect in impeding motion; it does not perceptibly arrest, absorb, or scatter light; it pervades, yet has (apparently) no share in the displacements of gross matter. Looking, however, below the surface of things, we find the semi-fabulous quintessence to be unobtrusively doing all the world's work. It embodies the energies of motion; is, perhaps, in a very real sense, the true *primum mobile;* the potencies of matter are rooted in it; the substance of matter is latent in it; universal intercourse is maintained by means of the ether; cosmic influences can be exerted only through its aid; unfelt, it is the source of solidity; unseen, it is the vehicle of light; itself non-phenomenal, it is the indispensable originator of phenomena. A contradiction in terms, it points the perennial moral that what eludes the senses is likely to be more permanently and intensely actual than what strikes them."

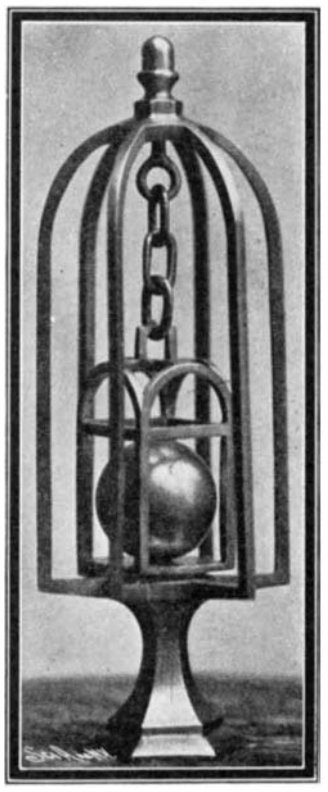
TOMATO VINES THIRTY FEET LONG.

BY H. L. JONES.

Throughout the winter months, when easterners were crouching about their fires and shivering, and nature growths were either asleep or frozen stiff with the cold, Mr. F. J. Bates, of Pasadena, Cal., was in his garden climbing an 18-foot ladder to gather his various crops of tomatoes. He has three plants which have reached a length of 30 feet. They are of the species "Ponderosa," but these particular plants have surpassed in growth anything previously attempted by their kind. The seeds were planted in May, and three months from that time they had climbed to the top of a 20-foot trellis. When they reached this remarkable height they waved their flower-tasseled heads wonderingly, then turned around and grew backward until they have attained a length of 30 feet. As the vines are still sprinting, Jack's beanstalk must sink into obscurity and transfer its fame to these irrepressible tomato plants. They have had no especial care or cultivation, and have had no protection from the weather, yet in spite of every disadvantage they have kept on growing and fruiting in the most astonishing fashion. The trunks of these vines are 1½ inches in diameter. The foliage is thick and luxuriant, and at all times blossoms, green fruit, and ripe fruit can be seen on the vines. Enormous quantities of tomatoes have been picked from these three plants. The fruit is of unusual size and has an extraordinarily fine flavor.

A CURIOUS PIECE OF CASTING.

We have already presented to our readers pictures of Mr. D. Galvin's interesting castings. Perhaps the accompanying illustration shows the most curious piece that Mr. Galvin has thus far succeeded in producing. The casting, we are assured, was made from wooden patterns and sand. Nothing else was used.



A CURIOUS PIECE OF CASTING.

The height of the casting pictured, from the top to the base, is 12 inches, its width 4 inches. The ball is 1⅞ inches in diameter, and the frame around the ball has an exterior measurement of 1¾ inches. The thickness of the metal of the frame, outside of the base, is 1-16 of an inch. Three of these castings will be exhibited in the Division of Mines and Metallurgy at the St. Louis Exposition.

Irrigation Profitable in the Humid Parts of the United States.

The advantages of irrigation in the humid climates, merely as a supplement to rainfall in ordinary or extra dry seasons, are forcibly presented in Bulletin No. 148 of the Office of Experiment Stations recently issued by the United States Department of Agriculture. The reports of a number of irrigation plants in the vicinities of eastern cities go far to show that as population increases and land becomes more valuable the zone in which irrigation can be profitably employed will be extended, as it has been in Europe, where the farmers have found that there are few sections where irrigation will not pay simply as an insurance against drought.

The bulletin states that a grower of berries in the vicinity of Poughkeepsie, N. Y., has found that artificial watering guarantees a perfect stand and rapid growth of newly-set plants, the highest quality of product, and maximum crops. Owing to dry weather and high temperature during the season of 1903 his berries had colored and hardened but did not sweeten. The application of 10,000 gallons of water in a fine spray and 25,000 gallons between the rows put the berries in fine condition for picking. He also found that to irrigate after applying chemical fertilizers dissolves and distributes the plant food and lessens the danger of injury to plants.

To water market gardens near New York city, on Long Island, and in New Jersey, small plants consisting of pumps, storage tanks, and piping are used with such success that their owners claim large returns on the money invested. One man stated that he would not attempt to garden for profit without such an assurance of plenty of water when needed. Some gardeners buy water from city supplies and find it more satisfactory than to install their own pumping plants.

Descriptions of pumping plants of various sizes and styles with their storage basins and distributing pipes are given in this bulletin so that those intending to try artificial watering may profit by the experience of several successful irrigators.

Striking testimony in favor of irrigation is furnished by the careful comparison of crops from irrigated and unirrigated plats of strawberries, asparagus, nursery stock, and onions at the Missouri Agricultural Experiment Station. Not only were yields larger, but in the case of asparagus unirrigated rows were affected with rust while the irrigated plants were entirely free from the disease.

A portion of South Dakota which is noticeably benefited by a supplementary water supply lies in the James River Valley. In the first attempts to utilize this supply of underground water, wells were made so large that the excessive cost resulted in financial loss. Within the last year or two the plan of sinking 1½ to 2-inch wells has been tried and its success is leading to their extended use. A good 2-inch well will furnish water for half a section of land. An oversupply of water in the first experiments produced conditions that prejudiced many farmers against the practice, but later tests show that no injury need be feared where water is properly used. All cases of deterioration are directly traceable to an oversupply of water. An excessive amount of water in the soil will smother the rootlets and on evaporation will leave a deposit of salt, so that care must be taken that the soil does not become too wet. The bulletin as a whole shows the great advantage of irrigation as a means of increasing production and as an insurance against drought, even where the expense of securing a water supply is great.

TOMATO VINES THIRTY FEET LONG.

What is said to be the first harbor for airships was that erected for the aerial contest at St. Louis. The ground made use of for this purpose covers about fourteen acres, inclosed by a wall for the protection of the vessels making ascent and descent, which operations will be greatly facilitated by a substantial shield of this character. At the southeast corner of this structure are two stalls for airships, each one 180 feet long and 40 feet wide and 30 feet high. There is also a shed 180 feet long and 20 feet wide where are all the facilities for making airship repairs and accommodations for the storage of ballast and other impedimenta. The wall inclosing the harbor is 30 feet high. The lower part of this structure is proof against the passage of wind, being absolutely tight to a point twelve feet above the ground. The upper part of the barrier is of latticework, which has the effect of tempering the breezes to a considerable extent. One of the practical results of the interest aroused in aerial matters by the contests arranged for at St. Louis is the investigation of the upper air of this country by the means of balloons containing automatically-recording instruments, and by this means it is expected to secure some very valuable data. The work is under the supervision of A. Lawrence Rotch, of the Blue Hill Meteorological Observatory.

Owing to the success of the cross-Channel turbine steamer "Queen," running between Dover and Calais, the South-Eastern and Chatham Company has ordered two more to be ready by next May or June.

Legal Notes.

ANTICIPATION BY PAPER PATENT—IDENTITY OF IDEAS.—The following remarks by Judge Brawley in the case of Ideal Stopper Company vs. Crown Cork and Seal Company (131 Fed. Rep. 244) will be found of interest to inventors. The invention involved was a bottle stopper. The single question presented was whether the Young British patent disclosed and anticipated the alleged invention of the Painter patent. The appellant's case rested upon the proposition that there is "substantial identity of the inventive idea of the Young patent with that of the Painter patent," and the argument of the appellant was that every element or feature of the Painter device is found in the Young patent. If the inventive idea was Young's, and not Painter's, and Painter had simply improved upon Young's conception, and if any skilled mechanic could take Young's patent and by a combination of the same elements, differing merely in degree or in detail, or in the substitution of equivalents, could produce a bottle stopper substantially the same as Painter's, merely varying the form of mechanism, but without involving any of Painter's ideas, then it would follow that Young was the pioneer in this art, and not Painter. But if the entire scheme of Painter was radically different from that of Young, and if, in construction, operation, purpose, and result, the invention set forth in Painter's patent was not responsive in terms or substance to the Young construction, and the same or non-equivalent elements were not used in substantially the same way to produce the same result, and no mechanical skill working upon Young's plan could ever produce the same result that Painter accomplished, then it would follow that the inventive idea was different, and any modification or improvements worked out upon Painter's idea must be tributary to it. The question to be decided was mainly one of fact, and, whatever doubt there may be as to the correctness of the court's conclusion, there is no doubt as to the legal principle which governed it.

Robinson, in his work on Patents (sections 272, 892, 893, 894, and cases cited), states the principle:

"The test of the question of identity in the inventive idea is whether 'the compared inventions perform the same functions by the same modes of operation. If the effects produced are substantially different, there is no identity. If the effects are the same, and the functions are essentially distinct, there is no identity. If the functions are the same, and the modes of operation by which they are performed are radically unlike, there is no identity. Contrariwise, where the effects are identical, the functions identical, and the modes of operation identical, the ideas embodied in the two inventions must also be identical.'" The court said:

"In determining the question of identity of the inventive idea, it is not a sufficient answer to say of any alleged anticipation that it was a mere paper patent, and that the same had not been operative or commercially successful; for prior existing conditions might not have stimulated full development. To discover the inventive idea that was in Young's mind, we naturally look to his statement of invention and to the drawings intended to illustrate it, for that is supposed to embody his ideas. We do not mean that Young's invention is necessarily limited to his own conception of its possibilities. Columbus would not be the less entitled to be considered to have discovered America because, when he set out on his voyage his object was, not to discover a new continent, but a new route to an old one; and if Young gave to the world an invention which was intended for one purpose only, yet which so clearly suggested the thought which afterward bore fruitage in Painter's invention, and which required only a more deft machine to develop it, then Young might justly be considered the pioneer in the art of inventing bottle stoppers, and Painter would be entitled only to such improvements as his mechanical skill wrought upon Young's invention. The line which separates invention from mechanical skill is at best a narrow one, and the difficulty of demarkation in this case is enhanced by the fact that of necessity we look upon Young's invention with eyes instructed by Painter's and other subsequent patents, and must take care that we do not in such light so reconstruct Young's patent as to see in it those possibilities which may seem very obvious now, but which may not have been disclosed by the patent itself; for, vague and uncertain as may be the line of demarkation between mechanical skill and invention, we could not deny Painter the right of invention, unless the idea upon which his patent is predicated is so clearly set forth or suggested by Young that a mechanic, with Young's patent before him, could by mere mechanical skill so modify proportions or change the mode of operation as to overcome the difficulties which excluded the prior device from commercial utility, and thus make fruitful the inventive idea which before was futile, merely through lack of the mechanical skill necessary for its development.

"This is not one of those great inventions that awaken admiration for the genius of the inventor and stir the heart like a trumpet. It is nothing but a bit of metal and a bit of cork, so co-operating that the result is something very simple, very cheap, very efficient, and so very much needed that the wonder is that nobody did it before, but nobody did. It is not surprising that Young did not, for he was not working toward this result. He only sought to devise a new method of holding down the stopper, not to produce a new stopper. He had a different conception, worked on a different plan, and produced a different effect. He, too, it is true, used a bit of metal so coiled as to enter the mouth of the bottle, which in its devolution might be flattened out. There is no shoulder under the disk groove, with diameter less than the unexpanded disk, which would prevent its slipping into the bottle; for this shoulder, according to Young's conception, was not necessary, as the disk was not designed to enter until the cork was in, and was to rest on that. His coil might, by unwinding, serve the purpose of holding the cork in its place; but it could not possibly, by the very law of its construction, maintain that close circumferential contact with the wall of the bottle neck essential to make an effective stopper, either with or without the packing or gasket. It has not and cannot have the permanent flexion which Painter's disk has. It is a cone of thin metal, something like a metal ribbon, which is designed to perform its function by unwinding, liable to overlap, and entirely incapable of forcible expansion against the wall of the bottle like a continuous flange. The primary idea that an efficient seal could be effected by it alone, or by the lateral pressure of its edges against a packing of elastic material which would thus insure the filling of any irregularities between the metal and the adjacent wall, is entirely lacking in Young's invention. Nobody has suggested, and nobody would pretend, that Young's disk alone could be used for sealing a bottle, while Painter's alone would seal the bottle, provided the bottle neck was perfectly round and regular; the gasket or packing being made necessary only by reason of the irregularities and imperfections incident to cheap bottles. It does not follow that the inventive idea is the same because each employed a metallic element and an elastic element to accomplish the same purpose; for, if terms are employed which avoid defining the distinctive character of the device or imperfectly describe it, few patents would escape anticipation, for nearly all employ the same elements. The imagination may find in Young's "disk of sheet metal" the cup-shaped disk of Painter; for men are prone to see what they want to see. Polonius saw in the cloud first a camel, then a weasel, and then something "very like a whale," as Hamlet bade him. Taught by Painter, we can see that a "disk of sheet metal" may be converted to a purpose altogether different to that which Young conceived, not by a mere mechanical change, but by a functional change, due to a conception of a different plan. Young, it is true, does not in his statement of invention require that his disk of sheet metal should be slit; but his drawing shows it, and it cannot operate on his plan unless it is slit radially to form the coil or cone to enter the bottle neck, so as to unfold. So, with the cork. It is not a mere matter of dimensions, for that is simply a question of proportion, merely one of mechanical judgment; but the difference between the cork as used by Young and the thin layer or packing used by Painter is a difference of function. With Young the cork is the stopper; with Painter the packing is merely ancillary to the stopper. The difference in the interior groove and shoulders in the bottle neck is also one of function. This has already been pointed out, but a mere inspection of the drawings shows it more plainly than any words of description.

"That there is a superficial resemblance between the two patents must be conceded, in that both use a combination of metal and elastic material; but it does not follow that there is an identity in the inventive idea, for, as we have endeavored to point out, each was guided and informed by a different purpose. The elements are combined upon a fundamentally different plan, and one cannot be merged into the other by mere changes in proportion or degree or by the substitution of equivalents. The mechanical skill which may be invoked to exclude the idea of invention must be mechanical skill applied in accordance with the direction of the alleged anticipating patent; not the skill which, taught by the invention in suit, seeks to reform and recognize the former patent, so disguising it under a cloud of subtlety of argument and suggestion as to transform it.

"The judgment of the court below is affirmed."

THE MANUFACTURE OF PATENTED INVENTIONS.—In the early days of patent law, it was the desire of the law-making bodies to give to inventors for a limited term the exclusive right to their inventions; and that inventors would, by neglecting to introduce their inventions, prevent industrial progress and fail to receive a reward for their labors, seemed to be highly improbable. But when, in the administration of the patent laws in some countries, it was found that inventors often delayed for a considerable time the introduction of their inventions, and, in some cases, the use of the inventions by society for the full patent term was prevented, the question whether the inventor should be required to commence the manufacture received consideration. By the failure of a patentee to introduce his patented invention, not only is its use prevented by the public, but where improvements on the device have been made by others, the use of the improvements is prevented even by their inventors. It will thus be seen what a serious loss to our progress in the arts is a failure by a patentee for a long period to introduce his invention.

Many of the foreign countries have laws requiring that a patentee commence the manufacture of the invention within a stated time, but such laws have been harsh remedies, which go to the other extreme in adjusting the rights of the patentee and the public. The question has been considered in some countries in a more judicial manner, and the rights and duties of the patentee and the public have been defined with a view to see that the public was not deprived of the use of the invention, but at the same time that the inventor received a full reward for the disclosure of his invention, and that his rights to the invention and to its use were protected. The value of an invention to an inventor is in its use, and when he is not using the invention, which use usually necessarily benefits the public, he is not receiving his reward to which he is entitled. By requiring a patentee, for a sufficient consideration, to permit another to use his invention, when he has neglected to use it himself, is not a great burden on the patentee. Many countries have therefore passed laws making patents, the owners of which have failed to commence the introduction of the invention within a reasonable time of the grant of the patent, subject to the grant of compulsory licenses. The principle of the laws is just and the rights of the parties will be afforded much better protection thereunder than under the old conditions which required the manufacture of the invention by the patentee.

In order to prevent any injustice, every compulsory license law which is passed should for a short period make the patents free from the grant of licenses, in order that the patentee may have an opportunity to commence the manufacture himself, and the term of the license should not be unnecessarily long, which might deprive the patentee of the opportunity at a future time to regain the sole right to the manufacture. Another important provision which the laws should contain is one which requires the applicant for a license to pay all the costs of the application, including the necessary expenses of the patentee, in order that the patentee's rights will not be sacrificed by a lack of funds which may be necessary to contest the right of the applicant to the license, the length of the term of the license, and the consideration to be paid.

The subject of the grant of compulsory licenses to persons who are prevented from the use of inventions by patentees, who do not use them themselves, is receiving renewed consideration because of the trend of popular opinion as illustrated in the provisions concerning the question, which have recently been incorporated in the patent laws of several foreign countries.

In the United States, patentees are not required to commence the manufacture of their inventions nor are they required to grant licenses when they neglect to manufacture.

CONTEMPT OF COURT IN DISOBEYING AN INJUNCTION.—In the case of the Westinghouse Electrical and Manufacturing Company vs. The Sangamo Electric Company (128 Fed. Rep. 747), application was made to punish the defendant for contempt in selling a meter alleged to constitute an infringement of complainant's meter, in violation of an injunction. The sale had been made under the advice of counsel that defendant's device did not infringe complainant's patent. This, while insufficient to protect the defendant if it were in fact an infringement, would be considered by the court in determining whether there was an intentional disregard of the injunction tending to bring defendant into contempt.

It appears that but a single sale had been made by the defendant since the injunction was granted, and that this was a meter differing in form, if not in principle, from the one established by the decree as an infringement.

A patent for an improvement or manufacture which does not accomplish the objects and purpose of its conception and is impracticable does not anticipate a later patent upon a similar device capable of successful operation, unless the objections to the device of the prior patent relate merely to details of construction, or where it can be converted into a successful device by a mechanic of ordinary skill.

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

ELECTRIC DISPATCH-BOX FOR OVERHEAD LINES.—R. T. PISCICELLI, Naples, Italy. The present invention relates to some improvements in the construction of the dispatch-boxes and of overhead lines to be used in the system of electric mail-service described in a former patent application, which improvements are intended to diminish the resistance of the line and of the air to the translation movement of the dispatch-boxes of the type described in said specification, at the same time diminishing also the trepidations of the line. Many of the improvements may find application in cases where electrically-propelled vehicles shall run at very high speed.

TRACK STRUCTURE.—L. STEINBERGER, New York, N. Y. Mr. Steinberger's invention relates to track structure and admits of general use, but is peculiarly applicable where it is desired to have a rail mounted movably upon its support. His invention is of special value in connection with electric railways, and especially as third rails used for the purpose of distributing electric currents to movable vehicles.

TROLLEY.—W. R. COOPER, East St. Louis, Ill. The trolley comprises a trolley pole consisting of two telescoping members so arranged that to reverse the car it is not necessary to swing the pole around in the usual manner but the motorman needs merely to reverse the motor when the pole will shorten due to the telescoping members sliding one upon the other and it will then lengthen out as it assumes its rearward inclination.

TROLLEY-WHEEL.—J. J. BOUCHARD, Bradford, Pa. In this patent the invention has reference particularly to the lubricating devices of trolley-wheels and the like; and the object of the inventor is to produce an improved construction of such wheels, having in view the efficient lubrication thereof.

Of Interest to Farmers.

FRUIT-GATHERER.—F. D. HENDRICKSON, Amboy, Wash. This invention is an improvement in that class of hand fruit gatherers or pickers which consists of a receiver or skeleton basket suspended and adapted to oscillate in the forks of an extended handle. Means are adapted to receive and detach fruit conveniently and for preventing injury thereto.

ENSILAGE-CUTTER.—M. W. DREW, Bliss, N. Y. In the usual cutting-wheels there are openings at the back of the knives, and while operating the husks or the like pass into these openings, wind around the wheel-spokes, and clog in the corners, thus throwing the wheel out of balance, and consequently requiring an increased power to run the machine. Mr. Drew's wheel obviates these difficulties.

CORN OR GRAIN KNIFE.—L. R. TILLEY, Colorado, Texas. The invention is in the nature of a device employing clipping-blades and adapted to be fastened to the user's hand. The blades are operated by simple closing and opening action of the user's fingers. The object had in view is to provide a simple, inexpensive, and novel device of this character adapted for clipping the heads of standing corn, grain, and for other similar use.

CRATE.—J. H. WINKELMEYER, Eldon, Mo. In the present instance the inventor has made an improvement in crates, especially designed for use in carrying poultry and the like and which can be knocked down for reshipment. Among the advantages means are provided for protecting the locking-bar against damage in piling crates upon each other, and also for securing the crates in knock-down position.

PLOW-WHEEL SCRAPER.—W. J. ROBINSON, Hudson, N. Y. The aim of the inventor is the provision of a new and improved scraper which is simple and durable in construction, easily applied to any type plow, and more especially designed for keeping the peripheral face of the wheel on the plow-beam free of dirt to allow plowing to a uniform depth.

INCUBATOR.—C. E. GOSS and G. W. GOSS, Edith, Texas. When it is desired, the eggs by this improvement may be rotated, as is necessary in artificial incubation, by moving the false bottom of each tray along through the slot in the slide until the end section has been withdrawn. The eggs will all be rotated through substantially half a turn. The hinging of this section permits it to hang vertically from the tray and avoids the closing of the space between it and the walls at its side.

INCUBATOR.—W. H. HUGHES, New York, N. Y. The inlet for fresh air passed through the egg-chamber is removed far as possible from lamp and outlet of heating-casing so as not to become contaminated by fumes of burning hydrocarbon, which if in contact with the eggs would likely injure them. Casing and chamber do not communicate and no danger arises there. Distribution of air about the casing makes it properly heated, and distributers insure even heat to eggs. Two regulators control temperatures, the controlling means for both being situated over substantially the center of the egg-trays, and under influence of average conditions in egg-chamber.

FENCE-POST.—J. M. NARSH, Fort Worth, Texas. Mr. Narsh has devised a post whose central portion web is thinner than its sides, so that while it has due strength and rigidity, adapting it to be driven without bending or buckling, the tongues for holding the fence-wires may be easily cut out of the same in process of manufacture. The post has reinforcements or fillets formed at its inner angles to materially strengthen the same longitudinally and transversely. Improved braces for the post are further devised by the inventor.

PROCESSS OF MAKING BUTTER.—W. A. IRWIN, Dallas, Texas. In this case the invention is in the nature of an improved process of making butter designed to increase the yield of the final product and to provide a wholesome, well-flavored, nutritious, and digestible food product for the table that shall utilize all or nearly all of the valuable constituents of the ingredients.

GATE.—W. H. FUQUA, Roswell, New Mex. This is a gate of the type in which a lever is employed to operate the gate, the lever being actuated by a pull-cord or by the passing of a vehicle. The mounts on the gate opening lever devices for releasing the latch. When the cord is pulled to actuate the gate lever its initial movement actuates the latch controlling device on said lever.

Of General Interest.

NEGATIVE-HOLDER.—A. J. WEED, New York, N. Y. The object in view in this case is the provision of an extremely simple article capable of easy application to the edge portion of a plate for holdiug the latter in a secure manner. A further object is to produce a holder which on application to a plate is bent in a way to produce bearing-points on which the holder when inverted may stand in a washing-bath, whereby the negative may be suspended with the film side facing downward in running water, so as to wash the film without exposing it to lodgment of sediment in the water.

TWINE-HOLDER.—R. L. WEIR, Winnsboro, Texas. The holder will always hold the end of the twine upward in most convenient position. This is attained by providing a body having a rounding bottom portion weighted with respect to the upper part of the body, so that no matter how the holder is thrown it will always roll with the weighted side of the body downward. From the upper side of the body a body is projected preferably in the form of a tube and through which the twine is drawn, so that the end of the twine always hangs from the upper end of the tube.

FIRE-ESCAPE.—H. VIEREGG, Grand Island, Neb. This invention refers to fire-escapes and admits of general use, but is of peculiar value in cases where it is desired to enable persons to escape singly and without assistance from any source by merely descending from a door or window. The invention is in general terms somewhat similar to a former patent granted this inventor for a fire-escape.

STEREOTYPE-CASTING BOX.—F. SCHREINER, Plainfield, N. J. The object of this improvement is the provision of a box constructed in such manner that any size of plates for printing can be cast with cores or legs that will cross each other level and produce type-high plates, so that whether a small or large sized plate is cast it will have level crossing bearings which will resist printing much better than those having lengthwise run-much better than those having lengthwise-running legs, as heretofore formed.

BACKING FOR DISPLAY-BUTTONS.—D. PUDLIN, New York, N. Y. One object in this instance is to construct a backing with a continuous inwardly-turned flange at its inner edge, the flange being turned in direction of the front portion of the backing, within which flange the shank of a pin is secured and concealed, thereby producing a continuous smooth inner edge surface, materially strengthening the backing and preventing the shank of the pin from working loose and projecting at its end to detriment of surface upon which the button may be fastened, as the shank of the pin is held securely throughout its entire length.

BUILDING CONSTRUCTION.—A. MENCZARSKI, New York, N. Y. In this patent the invention relates to fireproof buildings; and it constitutes an improved structure for forming the floors and ceilings of such buildings. This construction provides a maximum dead-air space between floor and ceiling, which is very essential in preventing transmission of heat, which transmission in case of fire would allow flames to spread quickly and also in lessening the weight of construction to the minimum.

PLATE-HOLDER.—W. F. FOLMER, New York, N. Y. The inventor's purpose is to provide a plate-holder which will not leak when a slide is being introduced into the holder or is being withdrawn therefrom and to admit of both movements of the slide being expeditiously and conveniently done. A further purpose is to provide a spring or tension controlled sealing device for the slide of the plate-holder applicable without necessarily weakening the holder and which will be expansive at all times without liability of light being admitted to the plates of the holder.

WATCH-GUARD.—J. A. CRANDALL, New York, N. Y. In this patent the invention relates to a watch-guard; and its main object is to provide means which may be attached to a watch and placed in the pocket of the wearer, whereby any attempt to remove the watch from the pocket will be prevented or the notice of the wearer attracted thereto. The device is not cumbersome nor is it expensive.

METHOD OF PURIFYING WATER.—T. JONES, Acme, Texas. The invention relates to purification of water, especially for domestic uses, the more particular object being to remove gypsum and certain carbonates, together with organic substances, should any be present. It admits of general use, but is of peculiar value in certain sections where housekeepers have been annoyed to a great extent by the presence of impurities in water.

FILE.—F. C. BILLINGS, Macon, Mo. The improvement made by Mr. Billings relates to a file of that class in which a box or case for the papers is provided, this box having an open side and a spring-retained follower to hold the papers snugly yet removably in place. It is designed especially as a means for conveniently holding music-sheets in condition for ready access, but may be useful for filing papers of any sort.

TIME HAND-STAMP.—W. F. BARTHOLOMEW, New York, N. Y. The object of the present invention is the provision of certain improvements in time hand-stamps whereby the handle carrying the pointer is automatically locked against accidental movement. It relates to stamps, such as shown and described in the application for Letters Patent of the United States, formerly filed by Mr. Bartholomew.

BUILDING CONSTRUCTION.—E. MAY, New York, N. Y. The object of this inventor is to produce a building construction or form which is well adapted for building floors, partitions, and for similar uses. When the cement or binding material has dried and become set a very firm and rigid structure results, and this, due to wires imbedded in the cement, is substantially reinforced or braced. The structure presents a very neat appearance, the cement not being exposed to view at the edges of the slabs.

POLE-HOLDER.—W. H. FUQUA, Roswell, New Mex. This invention is an improvement in pole-holding apparatus especially intended for holding heavy poles, such as telegraph, telephone, and other poles. It sets a pole quicker than in the ordinary way, and if bent or crooked small wedges interposed between sections and the pole tilt the pole as required. The pole is elevated about one foot from the ground so that a pole decayed in the ground is in many respects as good as new, and in applying the improvement to a pole in the ground the latter will not have to be moved in any way.

OIL-CUP.—A. UHRI and A. G. HOUCK, Florence, Col. Messrs. Uhri and Houck in this invention have for an object the provision of a cup of few and simple parts that may be more conveniently opened and closed than the ordinary cup and adapted to reliably feed thick oil or grease for lubricating purposes. The cup is specially suited for use in roasters, kilns, etc., where an oil-cup is necessarily exposed to unusual heat.

METALLIC BUTTONING DEVICE.—E. I. RAINS, New York, N. Y. The inventor claims as an object the provision of a device more especially designed for yieldingly connecting a boy's pants with the shirt-waist or blouse and arranged to readily compensate for strains, especially when the wearer bends over in a forward direction, the device yielding sufficiently to prevent breaking or tearing of connected parts.

ADJUSTABLE SUPPORT.—E. T. PALMENBERG, New York, N. Y. The intention of this inventor is to provide an adjustable support for carrying display glass plates, trays, shelf-boards, and the like and arranged to allow convenient adjustment of the support for different widths of the plates, shelf-boards, etc., and to securely hold the same in position. The invention relates to window and store fixtures.

DISPLAY-FIXTURE.—E. T. PALMENBERG, New York, N. Y. In this patent the improvement relates to window and store fixtures; and its object is to provide a display-fixture in the form of a universally-adjustable arm adapted to be moved conveniently into any desired position for the display of the goods to the best advantage.

MOLDING-FLASK.—W. MARSHALL, Lyndon, Kan. The improvement refers to a flask which, although capable of general use for molding plastic substances and casting metals, is especially applicable for the molding of rubber and composition dental plates. The principal objects are to provide a flask of this character which can be readily taken apart, which will have no projections easily breakable, and which will provide a surface which will leave ample room to work on the teeth after they are invested.

TRUNK-FASTENING.—T. J. LIVSIE, Norfolk, Va. In the present case the invention is an improvement in trunk-fastenings, being in the nature of a combined strap-fastening and lock, so arranged that the lock will hold the strap taut and the device for connecting the strap will operate as a lever in tightening the strap in the use of the device.

Heating and Lighting.

COMBINED STEAM-GENERATOR AND GRATE.—J. C. RAYMOND, New York, N. Y. By this invention Mr. Raymond seeks to provide a grate in the form of a tube wound helically, producing a cylindrical grate with the openings between the coils of sufficient size to permit the escape of ashes and at the same time sufficiently small to retain fuel when it is being burned. The grate is designed for use with coal, coke, wood, or the like, and provision is made for introducing the fuel and for removing cinders from time to time.

Household Utilities.

BEDSTEAD.—A. FIELDS, Gilmerton, Va. Briefly stated this invention relates particularly to a novel construction of head and back rest adapted for adjustment to support a person in bed at any desired inclination. It is especially adapted for use in connection with and to form a part of an iron or other metal bedstead; and can also be applied to wooden or other bedsteads as desired.

FOLDABLE METALLIC BEDSTEAD.—C. P. BROWN, Springlake, Mich. The leading feature of this invention is the provision of means by which the bed-frame is balanced without resorting to weights, springs, or the like, thus making the operations of raising and lowering the bed-frame easy and rapid. Means provide for drawing the several parts into firm interlocking relation when unfolded for use. It relates to improvements of the kind disclosed in a prior application filed by Mr. Brown.

Machines and Mechanical Devices.

APPARATUS FOR COATING NAILS.—C. WAGGONER, Kokomo, Ind. The improvement made by Mr. Waggoner in this case has reference to apparatus intended particularly for coating nails with a cement compound, but useful for various other analogous purposes, as will be seen by skilled mechanics. Means provide for suiting the apparatus to handle nails of any size.

LATHE TEST-INDICATOR.—G. G. RIGGS and A. E. BABIN, Waterbury, Conn. The invention relates to indicators used for centering and truing up work to be turned upon a lathe. It presents certain improvements in the construction of such apparatus whereby the same is rendered more efficient, accurate, and sensitive and also whereby it is given a combinational character and admitting of quite a variety of uses readily suggested to those skilled in the art.

STOP MOTION.—H. L. POWELL, St. Marys, Ohio. The improvement refers to a mechanism for automatically stopping the motion of rope or equivalent transmission means upon breakage or other derangement thereof. According to the embodiment of the invention the inventor employs a prime-moving device restrained by the normal transmission means and active upon the derangement of said means, this device when active transmitting movement to devices for throwing out of action the driving mechanism.

TRANSMISSION-GEAR.—A. E. OSBORN, New York, N. Y. In this patent the invention has reference to a means for transmitting motion at different speeds and in different directions. It comprises a system of gearing of the sun-and-planet type especially adaptable to motor-vehicles, but useful in other connections—as, for example, on machine tools. Primarily, the object is to provide a gear of this character having the least number of parts consistent with sufficient strength and efficiency.

VARIABLE SPEED AND POWER TRANSMISSION DEVICE.—C. L. ROSENQVIST, Niagara Falls, N. Y. In transmission of motion and power from a prime mover to a machine or the like which is subjected to considerable variations in load strains it is essential that means be provided whereby compensation is afforded for such variations of load by altering the speed of motion correspondingly, also that slip of transmitting medium be avoided, and that changes in speed be effected either quickly or gradually, while driver and driven machine are in motion. The device affords a very simple practical speed-changer that is very effective and reliable in operation. The inventor states that he has an apparatus in operation.

COIN-CONTROLLED MECHANISM. — H. MEYER, New York, N. Y. The object in this invention is to provide a mechanism designed for starting the motor or other actuating mechanism of a self-playing musical instrument or the like and arranged to utilize the proper coin introduced as a part of the operating device, to prevent spurious coins from being effective, and also to prevent repetition unless a new coin is introduced.

SELF-PLAYING PIANO.—H. MEYER, New York, N. Y. In Mr. Meyer's invention the object of the improvement is the provision of a self-playing piano arranged for the note-sheet to automatically control pneumatic devices for moving either the hammer-rail or the damper-rail into an active position, to hold the same therein the desired length of time, and to then release the rail for the latter to assume its normal position.

VENDING-MACHINE.—F. LYNES, Johnstown, N. Y. The aim of this inventor is to provide, in connection with ejecting devices, novel devices for catching and discharging disks of hard or other magnetic material that may be placed in the coin-chute, for preventing the entrance of coins when the machine is open or in operation, for discharging a disk of lead or similar soft metal, also a novel means for ejecting the articles vended.

SIPHON.—W. P. LOCKE and H. D. MINNICK, Canton, Ohio. That class of siphons which are provided with a starting attachment consist-

ing of air-exhausting mechanism, is improved by this invention. Liquid air is received into a chamber which is provided at one end with a collapsible bulb and at the other with an outlet-valve, other valves being provided for controlling the escape of air.

SHINGLE-CUTTER.—M. KNAPP, Enid, Oklahoma. In this patent the object of the inventor is to produce a device which will efficiently serve the purpose for which it is designed, be rapid in its operation, and easily applied. Mr. Knapp's invention relates to shingle-cutters, and is intended especially for the purpose of trimming or cutting the course of shingles on the comb of a roof.

DOUGH-KNEADING MACHINE.—G. M. EULER, St. Louis, Mo. In the present invention the improvement has reference to dough-kneading machines and analogous devices in which it is desirable to knead or work a plastic substance such as dough and in which it is desirable to shift the same from one pan to another with a minimum expenditure of labor.

FRICTION-CLUTCH.—A. P. BROWN, New York, N. Y. In this patent the invention relates to improvements in friction-clutches for shaftings or pulleys, an object being to provide a simple and novel means for holding the friction parts together with a uniform pressure, thus reducing the wearing away of the parts to a minimum.

MANUFACTURE OF PASTED TUBES FOR CIGARETTES.—A. BENOIT, J. GUÉNIFFET, and J. NICAULT, 7 Rue Déparcieux, Paris, France. It frequently happens by a former arrangement that paste expulsed by pressure becomes deposited on an inner support to such extent that the passage of the paper tube is prevented. The present invention avoids this, because the pressure required for the pasting operation is produced by two means located outside of paper tube with interposition of a supply-surface within the latter. Obstruction of these means is therefore not feared, but occurring, can be removed at once. The device has the effect of flattening the tube between the two pressing parts; but the tube's cylindrical form is restored immediately after pasting by a device located beyond the pressing parts.

WELL ATTACHMENT.—H. W. CLARK, Mattoon, Ill. Mr. Clark's principal objects are to provide means for increasing efficiency of the associated pumping mechanism and for the cleaning of the well-casing. Considerable increase in efficiency results from the production of the vacuum within the casing and it will also avoid the waste of power in pumping air, as is liable to occur when the well is open at the top. The ready and effective means of keeping the casing free also adds to the pump efficiency.

Prime Movers and Their Accessories.

STEAM-BOILER.—J. F. HECKMAN, Hermann, Mo. The invention relates to steam-boilers; and the principal object of Mr. Heckman is the provision of a steam-boiler of a construction by which the collection and removal of all sediment or scale deposits therein are facilitated and the effectiveness and working capacity of the structure materially increased or enhanced.

VALVE-MECHANISM.—H. L. GERKEN, New York, N. Y. In this case the invention relates particularly to improvements in valves and distributing mechanism for radiators, the object being to provide a valve of simple construction and positive in its operation that will permit a supply of steam, hot water, or refrigerating liquid to one or more divisions of a radiator or to one or more radiators at will.

Railways and Their Accessories.

DERAILMENT-GUARD.—E. MUELLER, Alsen, N. Y. The present improvement relates to a safety attachment for the trucks of railway-cars, the same being adapted to slide upon the rails and afford support for the trucks and also automatically apply the air-brake when the wheels of the truck are derailed.

Pertaining to Vehicles.

VEHICLE.—P. A. LINDROSE, Hattiesburg, Miss. The invention relates particularly to improvements in trucks to be used as a part of an eight-wheel wagon for carrying heavy loads, such as timber and the like, an object being to provide a truck that will be very strong and of comparatively simple construction. By ball-and-socket connections the front and rear axles are permitted vertical movement to a certain extent one relating to the other in passing over rough ground. The formation of an eight-wheel wagon is secured by the provision of a loop-plate by which two trucks may be hooked. In backing, means are provided when necessary to lock a bolster to prevent the latter turning.

VEHICLE-WHEEL.—E. GASTAL, Pelotas, Brazil. The object of this invention is to provide a wheel which is simple and durable in construction, more especially designed for use on railroad-cars, street-cars, wagons, and other vehicles, and arranged to reduce noise and the vibration incident to the wheel traveling on the rail or road to a minimum.

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WANTED.—Gasoline engine to build on royalty arrangement, or would buy. Chicago machinery manufacturing house. Engine must be practical, powerful, and adaptable mainly to small runabout automobiles. Address Machinery, Box 773, New York.

Inquiry No. 6214.—For manufacturers of wire-weaving machinery.

Inquiry No. 6215.—For makers of a small watch charm monkey wrench and novelties of this character.

Inquiry No. 6216.—For dealers in stoves with hot water back, to supply hot water in large quantities.

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Inquiry No. 6220.—For machines for making small nails.

Inquiry No. 6221.—For machines for making cigarettes.

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Notes and Queries.

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Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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(9479) H. W. L. asks: 1. Will dipping a razor into boiling water affect the temper in the least? I find that it gives a much smoother shave by so doing, and attribute it to the possible melting of microscopic saw edge. Nearly every barber, however, will tell you that it will soon ruin a razor by taking out the temper. A. We have supposed that the improvement in the edge of a razor, which is brought about by dipping it into hot water just before shaving, is caused by the heat expanding the edge and thus closing up the fine serrations of the edge, and rendering the edge smoother than before. This does not bring the steel up anywhere near the temperature required to draw the temper. We cannot believe that it has any effect upon the hardness of the blade. We have done it on razors for years, and never thought they grew soft. When a razor becomes soft, it seems more reasonable to suppose that the edge was at first harder than the blade farther back, and by honing and grinding the hard edge is worn off, bringing the wear down to the softer part of the blade. 2. How can I make the white paste that the several ink manufacturers put up, both in tubes and jars? A. For a durable white paste, dissolve white glue in water of twenty times its weight. Stir, and while hot add four times the quantity of starch paste, boil and stir. When cooling, add a few drops of carbolic acid. We can look up the patents on so-called "library pastes," and send you three or four copies for $1.

(9480) H. L. C. asks: I wish to know of some simple method of sensitizing paper or cloth for blue-print work. My idea is to make blue prints on letterheads, handkerchiefs, etc., and I wish to get the formula for sensitizing same. A. To prepare blue-print paper, take potassium ferricyanide, red prussiate of potash, 1 ounce, and dissolve in 5 ounces of water. Make a second solution by dissolving 1 ounce of citrate of iron and ammonia in 5 ounces of water. Keep the two solutions in well-stoppered bottles. They will keep indefinitely. For use take equal parts of the two solutions, and mix in a dimly-lighted place; pin the sheet of paper to be coated upon a board and apply this mixture, by lamplight, to the paper, with a soft brush, a swab of cotton, or a small sponge, as rapidly and evenly as possible, in strokes first lengthwise and then crosswise, then pin up to dry in the dark. The work must be done in the dim light, since the liquid is sensitive to the light as soon as the two solutions are mixed. Be very careful in the use of these liquids, as all cyanides are poisonous. See SUPPLEMENT Nos. 584, 679, and 1385, price 10 cents each, mailed.

(9481) H. O. N. asks: 1. Have a small hand dynamo which is rated at 10 volts, 1 ampere. Could this be used to recharge a small dry battery, and how long would it take to recharge one battery? A. Your hand dynamo will charge five dry cells in series. We cannot tell how long it will require to recharge the cells; a long time with one ampere of current. You cannot charge one cell alone with the dynamo, the voltage is too great. Allow two volts per dry cell, or five cells in series for ten volts. 2. On page 468, Vol. 2, "Experimental Science," Prof. Trowbridge speaks of attaching Leyden jars to the poles of his storage batteries. What effect would a Leyden jar have on the voltage and amperage of a voltaic cell? A. The battery which Prof. Trowbridge describes has 10,000 cells in series or 20,000 volts in direct charge. This is sufficient to charge a condenser or Leyden jar, so that a heavy shock would be had from it. A Leyden jar would not be appreciably charged by a single cell of battery. 3. What is the usual height from crest to hollow of a wave on the Atlantic during an ordinary storm, and what is the highest that has ever been recorded? A common phrase in descriptions of a storm at sea, "when waves run mountain high." Is this exaggeration, or is this the appearance of the waves when on board a ship? A. Storm waves on the ocean are from 30 feet to 40 feet in height, and seldom exceed 50 feet. These numbers are on the authority of Prof Davis's "Physical Geography," which we can supply you for $1.50 by mail. Such a wave would look "mountain" high if you looked up at it from its trough, expecting it to break over you.

NEW BOOKS, ETC.

MAXWELL'S THEORY AND WIRELESS TELEGRAPHY. New York: McGraw Publishing Company. 12mo.; pp. 247; 145 illustrations. Price, $2.

This excellent work contains, in a single volume, two distinct parts entitled, respectively, "Maxwell's Theory and Hertzian Oscillations," by H. Poincaré, translated by F. K. Vreeland, and "The Principles of Wireless Telegraphy," by Vreeland.

The part of the book entitled "Maxwell's Theory and Hertzian Oscillations" comprises a popular version of Maxwell's great treatise divested of its abstruse mathematics, together with a graphic account of the confirmation of Maxwell's theory by the subsequent experiments of Hertz and his followers.

This portion of the book certainly fills a long-felt want. To the person of average training Maxwell's writings have little or no meaning, because of their mathematical nature. In this book Maxwell's theory is presented in the light of mechanical analogues or models, accompanied by simple explanations. The experiments of Hertz are also portrayed so as to be readily understood.

The second portion of the book is devoted to the principles of wireless telegraphy, and to some extent follows the style of similar publications. Two noticeable improvements, however, are made, to wit, the elimination of much threadbare literature of a historical nature, and the omission of the usual misleading accounts of the alleged commercial success of the various "wireless systems," used principally for the sale of stock to the public.

GETTING A LIVING. The Problem of Wealth and Poverty—of Profits, Wages, and Trades Unionism. By George L. Bolen. New York: The Macmillan Company, 1903. 8vo.; pp. 769. Price, $2.

Immediately the question thrusts itself upon us, From what standpoint does the author write—from that of labor or of capital? Of employer or of employe? And until that question is satisfactorily answered, we shall all be inclined to regard the discussion with suspicion. Mr. Bolen defines his position in a convincing preface. He has been, at different times of his life, employer and employe, both in small industries and in large; has been a striker, and has been struck against. His experiences cover North and South, country districts, great cities, and large mines. To do him justice, the volume gives both sides of the case with commendable impartiality, and presents, aside from any personal opinions of the writer, a mass of facts that are matters of record. No man will be the worse for reading the book, and no man can read it without profit and enlightenment. Mr. Bolen seems to have no pet scheme or pet theory to advance, but simply states and discusses facts as they appear to him, with a view to opening men's eyes to actual conditions, and leading them to see that measure of right which is usually to be found on both sides of most vexed questions.

WHAT HANDWRITING INDICATES. An Analytical Graphology. By John Rexford. New York and London: G. P. Putnam's Sons, 1904. 12mo.; pp. 142; illustrated. Price, $1.25.

Nothing strikingly new or original is claimed for this work, but the author has presented his material in such a way that it is readily accessible to the student, whereas in most works dealing with graphology one has to memorize all the signs and their significations before accomplishing much in the way of actual analysis. The specimens of handwriting offered as illustrative of different styles and traits are numerous, and include facsimiles of writing from the pens of authors, statesmen, criminals, lunatics, and men half asleep.

MECHANICAL DRAWING SIMPLY EXPLAINED. By F. E. Powell. London: Percival Marshall & Co., 1904. 12mo.; pp. 78. Price, 25 cents.

This pamphlet is a reprint of articles published in the Model Engineer, and in it the author attempts to show the student, apprentice, and amateur engineer briefly how to set about such drawing-office work as his case requires, besides enabling him to understand mechanical drawings and assisting him to prepare practical drawings or sketches of his own. The chapter on "Drawing for Reproduction" gives some useful hints to the tyro. The book is illustrated by nearly fifty cuts, giving samples of drawing, methods, and instruments.

INDEX OF INVENTIONS

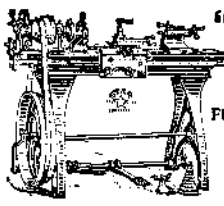
For which Letters Patent of the United States were Issued for the Week Ending November 8, 1904

AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents.]

Abrading material and mounting therefor, R. Gardner 774,513
Advertising, etc., apparatus for, H. J. Chart 774,647

Air ship, T. C. Benbow 774,643
Anchor, earth, G. H. Miller 774,687
Animal trap, S. S. Elder 774,164
Animal trap, J. R. Emery 774,165
Animal trap, J. M. Wilkinson 774,628
Apparel, wearing, A. Tishler 774,344
Apparel, wearing, J. Rathschuler 774,452
Armor shield, B. Behr 744,303
Auger, adjustable earth, G. Stevenson.... 774,368
Automobile, F. B. Brock 774,556
Axle, vehicle, M. E. Thomas 774,289
Barber's cabinet, Ebert & Tuckfield..... 774,314
Barbers' chairs, paper serving box for, W. Reuter 774,453
Basin for sink outlets, catch, H. Robischon 774,201
Basket handle, R. C. Totzke 774,542
Bathing apparatus, Dudley & Bebout..... 774,657
Bearing, ball, E. G. Hoffmann 774,427
Bearing, roller, H. A. Lockwood..... 774,678
Bed bottom, spring, F. Karr 774,670
Bed, folding, J. H. Bennett 774,148
Bed, folding, A. W. Pyle 774,275
Bed spring, E. Jewell 774,180
Bedstead guard, C. H. Wright 774,462
Beet topper and puller, E. O. Cady..... 774,646
Belt clip, catamenial, A. E. Luzzi 774,191
Belt holder, L. B. Garman 774,576
Belt shipper, E. Kottusch 774,358
Berry box, E. M. Averill 774,300
Bicycle handle bar, H. D. Griswold 774,421
Billiard cue bridge, K. Van Setres..... 774,621
Binder, J. O. Deckert 774,509
Binder, temporary, T. A. Glendinning..... 774,516
Binder, temporary, J. R. Barrett 775,550
Binding post, H. J. Guttman 774,469
Biscuit cups, manufacture of, A. Judka.... 774,586
Blast charger, J. Lord 774,590
Block. See Building block.
Bloom shears, C. L. Taylor 774,287
Bobbin, shuttle, A. G. Lamb 774,188
Bodkin, M. L. Hotchkin 774,585
Boiler tube cleaner, J. A. Sagerdahl 774,699
Boilers by exhaust steam, system of heating, J. Nadrowski 774,334
Bolt cutter, C. K. Lassiter 774,676
Book holder, L. Block 774,152
Books, machine for applying fly leaves, etc., to signatures of, W. I. Lewis... 774,726
Boom, Fairbanks & Sauer 774,240
Bottle, etc., carrier, C. W. Desobry..... 774,569
Bottle, non-refillable, M. Tittel 774,617
Box, J. Dobos 774,570
Brake beam clamp, E. C. Totten 774,211
Brake mechanism, automatic, A. E. Norris 774,448
Bread making apparatus, E. D. Lynds.... 774,680
Brush, S. R. Boon 774,553
Brush, J. McDermott 774,689
Building block, S. O. Hawkinson 774,174
Building construction, J. Wills 774,545
Building or paving block, W. H. Reiff 774,276
Bundling apparatus, Wiseburn & Buhle... 774,226
Burglar alarm, H. T. Johnson 774,668
Burglar alarm system, H. D. Stroud 774,342
Burner, G. G. Smith 774,456
Burnishing device, W. J. & J. R. Mitchell 774,444
Butter cutter, A. C. Hummer 774,389
Button, lapel, G. S. Engle 774,382
Cake beater, M. A. Ritter 774,697
Cake dresser, rotary, R. F. Stevenson.... 774,541
Calculator, H. M. Seitzinger 774,281
Calendar, R. Illing 774,325
Camera, photographic, W. H. Cooley..... 774,565
Cameras, lens support for ground glasses on, H. T. Donnan 774,656
Can capping machine, C. B. McDonald.... 774,195
Can cooling apparatus, Hopkins & Fellows. 774,177
Canopy frame coupling, I. E. Palmer..... 774,393
Capsule decapping, filling, and recapping machine, A. K. Carter 774,378
Car automatic stop, cable, A. M. Green.. 774,244
Car bolster, R. V. Sage 774,698
Car coupling, C. Dietz 774,236
Car coupling, R. Reardon 774,533
Car door mechanism, Lindstrom & Ditchfield 774,588
Car, dumping, S. F. Swanson 744,614
Car end stake, C. A. Lindstrom 774,589
Car fender, retractible, A. D. Pidgeon.... 774,396
Car grain door, Mauppin & Keller..... 774,526
Car, mule or pusher, E. Esselius 774,166
Car, railway, M. A. Garrett 774,354
Car, railway, C. H. Howard..... 774,474
Car replacer, W. P. Brittain 774,153
Car underframing, Williamson & Pries.... 774,222
Car vestibule trap door, A. W. Zimmerman 774,504
Cars, system of upper framing for railway, G. W. Scott 774,205
Carbureter, H. Marshall 774,486
Carbureter air and gas mixer, I. E. Butler. 774,307
Carbureting apparatus, air, H. Marshall.. 774,485
Carpet stretcher, J. J. Moore 774,596
Carpet wire and cutter, A. Price 774,695
Carrier. See Bottle carrier.
Carton cabinet, F. M. Thorpe 774,291
Cartridge, flash powder, I. G. McColl..... 774,333
Caster, Z. J. Quinn 774,366
Caster wheel, W. A. Henderson..... 774,424
Casting and hardening of metal for armor plates, etc., direct, W. E. Everette.... 774,167
Cellulose acetate, W. H. Walker.. 774,713, 774,714
Cement, F. Suter 774,286
Chain jack, J. M. Butcher 774,231
Chain link, split, W. J. Laughlin..... 774,189
Checks, system of protecting bank, S. M. & M. L. Trapp 774,345
Chimney base protector, G. W. Lewis 774,258
Chloral, continuously producing and rectifying, J. A. Besson 774,151
Christmas tree holder and display stand, J. A. Rompel 774,497
Chuck, milling, J. & W. R. Thomas..... 774,616
Cigar case, G. G. Macdonald 774,681
Cigar cutter, M. Stratton, Jr..... 774,208
Cigar lighter, electric, Waters & Thompson 774,624
Cigar mold compressing and opening device, H. M. Dalton 774,648
Circuit closing device, H. T. Johnson.... 774,436
Clay working machinery, R. Buhler 774,559
Clothes drier, T. P. Cavanaugh 774,379
Coaster, N. Campbell 774,348
Coating, composition, A. H. Stillwagon.... 774,500
Cock, ball, A. F. Morency 774,194
Cock, gage, A. J. Fink, Jr. 774,510
Coffee, cleaning, Hastings & Harrington.. 774,725
Coin receptacle, J. W. Stephens 774,707
Coke quenching and bleaching apparatus, E. A. Moore 774,330
Colander, fruit, L. P. Castle 774,350
Collar fastening device, E. Sibbald 774,339
Collar turning apparatus, J. M. Beiermeister 774,147
Combing machine attachment, A. A. Sack. 774,399
Combs, traverse mechanism for warper, A. E. Rhoades 774,696
Compasses, drawing, D. W. Macdonald 774,327
Composite post, I. L. Landis 774,438
Composite post, J. J. Luck 774,441
Composition of matter, L. Champowich.... 774,156
Conduit threading machine, E. U. Mack... 774,525
Confectionery machine, W. S. Sampson.... 774,204
Conveyer, N. H. Larry 774,256
Conveyor, D. E. Hughes 774,476
Conveyer, G. Carlson 774,560
Cord tip, J. R. Barrett 774,716
Cork substitutes, making, F. H. Brooks.. 774,645
Corn husking machine, G. Peters 774,395
Corn or bunion shield, I. A. George 774,317
Corset, E. Savoye 774,537
Counter fixture, A. W. Frey 774,170
Counter, profit sharing sales, H. Hepfer.... 774,322
Counter, sales, J. A. Flesch 774,511
Coupon system, interchange of trade, L. N. Singley 774,538
Crate, collapsible, E. A. Keck 774,183
Crate, folding, E. M. Averill 774,301
Cross arm brace, F. B. Cook 774,159
Cultivator, M. G. Graham 774,319
Curling tongs support, L. M. Kate..... 774,671
Current motor or water wheel, J. S. Mathews 774,592
Cushion. See Spring cushion.
Cut out, drop circuit, F. J. Russell 774,203
Damper regulator, E. K. Hutchison..... 774,179
Damper regulator, automatic, J. F. Wood.. 774,631
Derrick, J. H. Fox 774,660
Die stock, J. J. Delehant 774,568
Directory, indexed mechanical, G. W. Maxwell 774,527
Display receptacle for objects immersed in preservative liquids, Greenman & Jayne 774,420
Distilling and preserving apparatus, wood, F. S. Davis 774,649
Distilling liquids, W. E. Garrigues 774,171
Ditching machine, J. H. Sylvestersen.... 774,458
Door, etc., attachment, screen, O. J. Coppins 774,351
Door catch, C. A. Borein 774,229
Door fastener, D. Wilde 774,627
Door, gate, etc., W. R. & R. Pitt..... 774,493
Door hanger, T. C. Prouty 774,338
Doorways, means for excluding drafts from open, T. Van Kannel 774,730
Doubling or other textile machines, hook for drop wires on, J. R. Mitchell..... 774,593
Draft evener, H. & J. H. Thiedemann 774,343
Draft rigging, L. A. Hoerr 774,388
Dredging device, J. L. Searfoss 774,280
Dress stand figure, J. Walker 774,370
Drying apparatus, G. D. Harris 774,321
Drill ball bearing, disk, O. S. Bakke 774,146
Drilling machinery, C. E. Willey 774,629
Driving connection, E. A. Johnston..... 774,182
Drum and cymbal attachment, bass, J. P. Stanton 774,539
Drum or winch apparatus, power operated, A. E. Norris 774,449
Dust guard, E. Denegre..... 774,651 to 774,653
Dyeing, etc., apparatus for, O. Venter.... 774,407
Ear phone, D. E. Smith 774,282
Edge runner, W. A. Merralls..... 774,329
Electric generator brush holder, I. Deutsch 774,163
Electric heater, flexible, S. S. Wales..... 774,623
Electric illuminating arrangement for railway vehicles, F. W. Schneider..... 774,701
Electric interrupter for high frequency currents, G. E. Johnson 774,181
Electric signal, F. H. Gray 774,320
Electrical circuit protective device, F. B. Cook 774,158
Electrical connection, F. J. Russell 774,202
Electrical coupling, F. J. Sprague 774,611
Electrically wound mechanism, liquid contact chamber for, P. L. Clark..... 774,728
Electrolytic apparatus, A. Brichaux 774,230
Electrothermic and vacuum appliance, C. C. F. Nieschang 774,529
Enameling kiln, J. S. Jobe 774,478
Enameling metal, C. F. Pfalzgraf..... 774,491
Engine leveling device, traction, F. & W. Holets 774,472
Excavating bucket, F. M. Ireland 774,431
Exhaust head, F. M. Overbolt 774,531
Explosive engine, R. Miller 774,392
Expressing machine, R. Oppenheim..... 774,530
Fat and making same, solidified halogenized, H. Winternitz 774,224
Faucet, G. L. Dawley 774,467
Fence knot or tie, wire, G. S. Tiffany... 774,210
Fence post, E. Bruley 774,306
Fence post, metallic, J. W. Altmyer 774,371
Fence post, metallic, G. B. Greer..... 774,582
Fence wire fastening device, E. Wheeler.. 774,295
Fender. See Plow wheel fender.
File, card index, J. H. Van Horn..... 774,215
File, paper, P. H. Yawman 774,410
Filter, water, J. H. Cox 774,233
Finger ring, C. Schmidt 774,700
Fire alarm, automatic, J. W. Griffin..... 774,385
Fire escape, Hamilton & Lewis..... 774,470
Fire extinguisher, chemical, C. Nuhring.. 774,336
Fire extinguishing device, automatic, J. Galvin 774,352, 774,353
Firearm safety device, O. G. Vold..... 774,712
Fireproof construction for floors, ceilings, etc., A. Forrester 774,512
Fish cleaning machine, J. Kellington..... 774,674
Fishing tackle, G. K. Hurlbut 774,429
Fixing box, H. D. Chichester..... 774,308
Flower holder, Temblett & McCoy..... 774,288
Fluid elevator, A. Brown 774,557
Folding stand, A. S. Marten 774,487
Food and preparing same, article of, E. T. Williams 774,221
Foundation, E. C. Hodges 774,176
Freight handling apparatus, F. B. Hewitt 774,520
Fuel and making same, artificial, M. F. Maginnis 774,682
Fuel, manufacture of artificial, J. J. Shedlock 774,705
Furnace, A. C. Calkins 774,232
Furnace for reducing and smelting nickel oxids, R. R. Maffett 774,591
Furnace grate, Girtanner & Simpson..... 774,663
Furnace hoisting apparatus, blast, H. Heffrin 774,387
Garment hook, W. Hippisley 774,426
Gas burner valve operating device, C. W. Currier 774,508
Gas condensers, conduit system for connecting, E. F. Lloyd 774,440
Gas hose coupling, H. Ackermann 774,633
Gas lighting apparatus, D. J. Clark 774,562
Gas machine, acetylene, E. F. & E. P. Clough 774,466
Gas manufacturing apparatus, C. R. Ingham 774,430
Gas producer charger, E. H. Carroll..... 774,561
Gas, recording calorimeter for, F. N. Speller 774,341
Gas scrubber, A. Steinbart 774,207
Gas tank closure, E. F. Lloyd 774,439
Gases, apparatus for vaporizing and regulating liquefied, G. B. Fraley..... 774,169
Gate, J. Granger 774,517
Gate fastener, E. F. Hopp 774,428
Gear, catch and escapement, J. Rettie.... 774,198
Gearing, W. H. Hultgren 774,252
Glass, device for carrying heated, R. W. Blaze 774,375
Glass melting and shaping device, M. J. Owens 774,690
Glass, pot furnace for melting, W. T. Nicholls 774,600
Glass tray, A. Lange 774,479
Glass, working, A. Swan 774,708
Glove, O. W. Noll 774,489
Glove fastener, E. W. Dyke 774,381
Glycerin from spent soap lyes, recovering, W. E. Garrigues 774,172
Governor, pumping engine, C. P. McMullen 774,266
Grass collector, dumping, J. H. Hirt..... 774,356
Grater, nutmeg, J. T. Welke 774,217
Grinding machine, E. Stead..... 774,612
Guns, shield mounting for quick firing, J. A. Wilson 774,223
Hammock frame or support, W. C. Poles. 774,272
Harvester weight sustaining and adjusting means, M. A. Grove 774,173
Hat fastening means, C. M. McConnell.... 774,598
Hay rack, W. H. Giese 774,662
Hide treating machine, H. F. Dougherty.. 774,238
Hinge joint, W. H. Wise 774,409
Holder, A. A. Low 774,259
Hoop pointing and lapping machine, A. F. Ward 774,216
Horn-like substance and producing same, elastic, L. Lederer 774,677
Horseshoe, W. H. Lake 774,187
Hose coupling, A. W. Nunn 774,196
Hose drier, C. M. Bowman 774,305
Hydraulic press, E. G. Budd 774,154
Implement attachment, C. A. Adams..... 774,143
Innersole, L. H. Vogel 774,622
Instantaneous heater, W. Wishart 774,268
Insulated rail joint, C. J. Buck 774,506
Insulator, fibrous material, R. Andlauer.. 774,548
Jack. See Chain jack.
Jacquard apparatus, B. S. Smith..... 774,610
Journal box, C. Williams 774,220
Keys, etc., dies for making, L. W. Gates.. 774,241
Keys, making cold forged, L. W. Gates.... 774,242
Kiln, W. N. Weir 774,544
Kilns, car for tunnel, A. A. Gery..... 774,243
Knitting machine, Barratt & Sibbald..... 774,464
Knitting machine, circular, H. A. Houseman 774,473
Knitting machine cloth wheel, A. A. Bailey 774,413
Knitting machine, straight bar, A. Woller. 774,299
Lacing hook, W. B. Estes 774,719
Lacing hook setting machine, L. F. Peck.. 774,271



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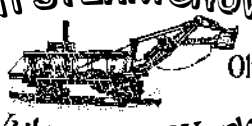
Toledo  Ohio, U.S.A.
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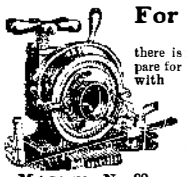

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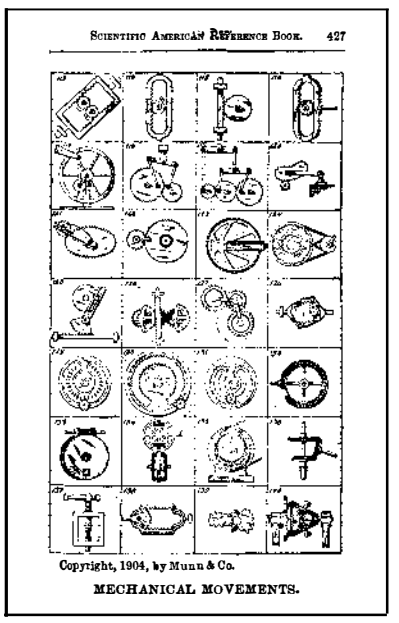

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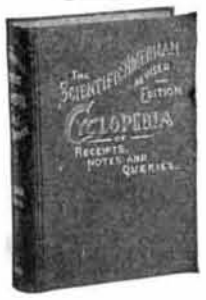

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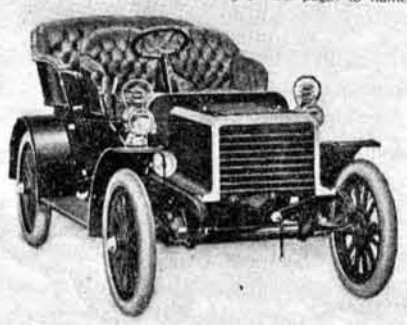

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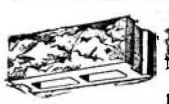

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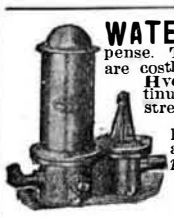

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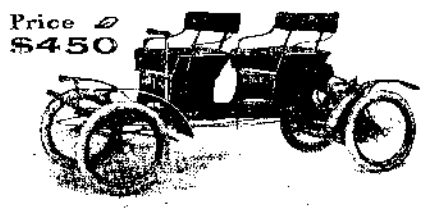

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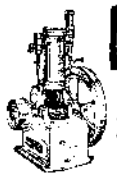

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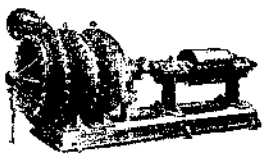

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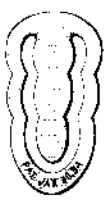

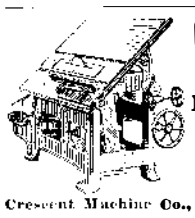

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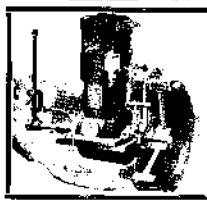

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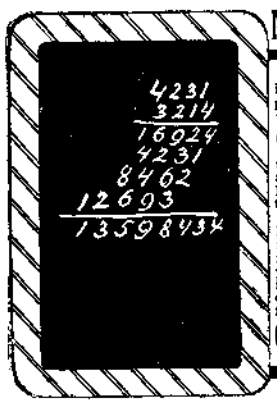

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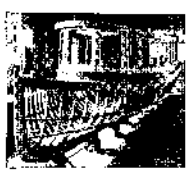

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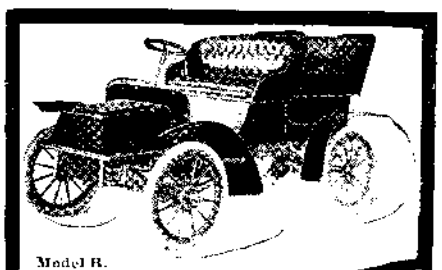

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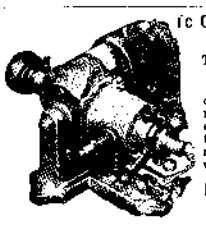

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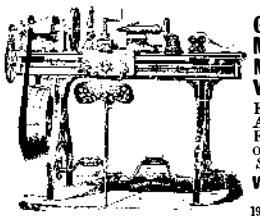

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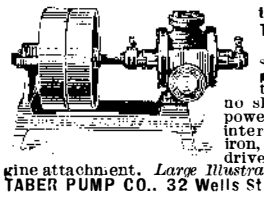

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